THE

HISTORY

OF THE

ROYAL SOCIETY of LONDON,

FOR IMPROVING OF

NATURAL KNOWLEDGE,

FROM ITS FIRST RISE.

IN WHICH

The most considerable of those Papers communicated to the SOCIETY, which have hitherto not been published, are inserted in their proper order,

AS A SUPPLEMENT TO

THE PHILOSOPHICAL TRANSACTIONS.

By THOMAS BIRCH, D.D.
SECRETARY to the ROYAL SOCIETY.

VOL. III.

Talem intelligo PHILOSOPHIAM NATURALEM, *quæ non abeat in fumos speculationum subtilium aut sublimium, sed quæ efficaciter operetur ad sublevanda vitæ humanæ incommoda.* BACON de Augm. Scient. L. ii. c. 2.

LONDON:
Printed for A. MILLAR in the Strand.
MDCCLVII.

THE

HISTORY

OF THE

ROYAL SOCIETY OF LONDON

FOR IMPROVING OF

NATURAL KNOWLEDGE,

FROM ITS FIRST RISE.

IN WHICH

[illegible]

AS A SUPPLEMENT TO

THE PHILOSOPHICAL TRANSACTIONS.

By THOMAS BIRCH, D.D.
Secretary to the Royal Society.

VOL. [illegible]

[illegible]

LONDON:
Printed for A. Millar in the Strand.
MDCCLVII.

THE HISTORY OF THE ROYAL SOCIETY of LONDON, FOR IMPROVING OF NATURAL KNOWLEDGE, FROM ITS FIRST RISE.

$167\frac{1}{2}$, Jan. 11. MR. ISAAC NEWTON was elected.

Sir FRETCHVIL HOLLES was proposed candidate by the president.

Mention was made of Mr. NEWTON's improvement of telescopes by contracting them; and that that, which he had sent to the Society of that kind to be examined, had been by the king, and considered also by the president, Sir ROBERT MORAY, Sir PAUL NEILE, Dr. CHRISTOPHER WREN, and Mr. HOOKE at Whitehall; and that they had so good opinion of it, as they concluded, that a description and scheme of it should be sent by the secretary in a letter to Monf. HUYGENS[a] then at Paris, thereby to secure this contrivance to the author, who had also written a letter to Mr. OLDENBURG from Cambridge, dated January 6, $167\frac{1}{2}$, altering and enlarging the description of his instrument, which had been sent him for his review, before it should go abroad.

This description was read, and ordered to be entere , together with the scheme, in the Register-book [b]. Mr. NEWTON's letter was as follows [c]:

[a] Mr. OLDENBURG's letter to Monf. HUYGENS was dated 1st January, $167\frac{1}{2}$, and entered in the Letter-book, vol. v. p. 92.

[b] Vol. iv. p. 123. It is published in the Philosoph. Transact. vol. vii. nº 81.

[c] Letter-book, vol. v. p. 95.

" The

"The description of the instrument you sent me is very well; only the radius of the concave metal, which you put 14 inches, is more justly $12\frac{2}{3}$ or 13 inches, and the radius of the eye-glass, which you put half an inch, is the twelfth part of it, if not less: for the metall collects the sun's rays, at $6\frac{1}{3}$ inches distance, and the eye-glass at less than $\frac{1}{6}$ part of an inch distance from its vortex. By the tools also, to which they were ground, I know their dimensions, and particularly measuring the diameter of the hemisphærical concave, in which the eye-glass was ground, I find it the 6th part of an inch.

"Perhaps it may give some satisfaction to Monf. HUYGENS to understand in what degree it represents things distinct and free from colours, and to know the aperture, by which it admits light. And after the words [—*versus focum E reflectatur*,] it may not be amiss to add this note:

"Conferendo distantias foci istius á verticibus lentis & speculi concavi, hoc est, EF $\frac{1}{6}$ dig. & ETV $6\frac{1}{3}$ dig. prodit ratio 1 ad 38, quâ judicatur objecta 38 vicibus circiter ampliari.

"And to this proportion is very consentaneous the observation of the crown on the weather-cock, for the scheme represents it bigger by $2\frac{1}{2}$ times, when seen through this, than through an ordinary prospective: and so supposing *that* to magnify 13 or 14 times (as by the description it should) *this* by experiment proportionably must magnify almost as much as I have assigned it.

"To the objection, that, with it, objects are difficultly found; I may answer, that that's the inconvenience of all tubes, that magnify much; and that after a little use the inconvenience will grow less; for I could readily enough find any day-objects, by knowing which way they were pointed from other objects, that I accidentally saw in it; but in the night to find stars I confess it troublesome enough: yet this may be easily remedied by two lights affixed to the iron rod, by which the tube is sustained. And such I once intended should have been made before I sent it away from me, but that I thought the defect would not be judged material. If such sights be not found a sufficient remedy, there may be an ordinary prospective-glass fastened to the same frame with the tube, and directed towards the same object, as DES-CARTES in his Dioptrics hath described for remedying the same inconvenience of his best telescopes.

"The plane side of the eye-glass is apt to be soiled with the dust falling upon it; and therefore the little leading ring, put into the orifice of the bigger leaden barrel to moderate its aperture, must be sometimes taken out, and the glass wiped with leather, done upon the small end of a stick, or other such like contrivance: but care must be taken, that the said ring be not lost, for without it objects appear very confused at the edges of the apparent space. So if the concave metal contract any dullness, by moisture or otherwise, it ought to be taken out and rubbed with gentle leather, but not with putty, or any thing that may wear the metal.

"I am

"I am very sensible of the honour done me by the bishop of Sarum in pro-
"posing me candidate, and which I hope will be further conferred upon me
"by my election into the Society. And, if so, I shall endeavour to testify my
"gratitude, by communicating what my poor and solitary endeavours can effect
"towards the promoting philosophical design."

It was ordered, that a letter should be written by the secretary to Mr. NEWTON to acquaint him of his election into the Society, and to thank him for the communication of his telescopes, and to assure him, that the Society would take care, that all right should be done him with respect to this invention.

Mr. OLDENBURG acquainted the Society, that he had received from Mr. TENISON [c] an account of the practice of agriculture in Huntingdonshire, in a letter written to him from Holywell, November 1, 1671; which relation was ordered to be joined to others of that nature.

Mr. OLDENBURG read a letter to him by Mr. VERNON from Paris, January 9, 167½ [d], describing the method observed by Monf. PICART in measuring the earth, whereby it appeared, that he assigned 57060 Parisian toises or fathoms, *numero rotundo*, to a degree, or seventy-three English miles, reckoning five thousand feet a mile.

Mr. HOOKE was exhorted to pursue and finish his way of measuring a degree, which he promised to do, hoping to bring it to a greater exactness and nearness.

Mr. OLDENBURG produced also a letter to himself, from signor CASSINI, dated at Paris, January 9, 167½ [e], concerning his observations lately made of a new planet near Saturn, the scheme whereof was delivered to Mr. HOOKE, to consider it, and thereupon to make the like observations.

January 18. Sir FRETCHVIL HOLLES was elected.

JOHN TILLOTSON, D. D. was proposed candidate by the lord bishop of Salisbury.

Mr. HORNECK presented the Society with some African curiosities, lately brought by a friend of his from Fez, *viz.*

1. A fair fruit of Coloquintida.

2. Coloquintida seed.

3. An herb called *albenna*, held for a panacea by the people of the country.

4. Another herb, good against sea-sickness; the name of which plant was not known to him.

[c] Afterwards archbishop of Canterbury. [d] Letter-book, vol. v. p. 99. [e] Ibid. p. 118.

5. A kind of mineral esteemed to be African lead-ore, of which some was given to Mr. Boyle to examine it.

6. Some earth like fuller's earth, used there in washings before the people go into their temples.

Mr. Oldenburg read a letter to him from Mr. Lister, dated at York, January 10, $167\frac{1}{2}$ [f], concerning veins in plants analogous to human veins. He was desired to pursue his intentions of making farther observations on this subject.

Mr. Newton's new telescope was examined and applauded.

Mr. Hooke made a proposition of a highly considerable improvement of all sorts of optic burning-glasses; which was this:

"The perfection of telescopes, microscopes, scotoscopes, and burning-glasses, " from lentes of figures as easily and perfectly made as plain and spherical, by " which the light and apparent magnitude of bodies may be most prodigiously " and regularly increased; and whatever almost hath been in notion and imagi- " nation, or desired in optics, may be performed with great facility and truth."

The way of performing this he lodged in these characters:

a	c	e	f	i	l	n	o	p	r	s	t	u	x
4	4	8	3	4	2	2	4	2	6	4	3	4	2.

He received the thanks of the Society, and was desired to impart the thing itself to the president for his lordship's perusal.

January 25. Dr. Tillotson was elected.

There was produced a reflecting telescope of four feet long, of Mr. Newton's invention; which, tho' the metalline concave was not duly polished, yet did pretty well, but was undercharged.

It was ordered to be perfected against the next meeting.

Sir Robert Moray shewed the Society a small piece of opaque glass made by Mr. Boyle, to serve for reflecting concaves.

It was ordered, that Mr. Boyle should be asked, whether larger pieces could be made of it for the use of Mr. Newton's telescopes.

Mr. Oldenburg read a letter to himself from Mr. Newton, dated Cambridge, 18 January, $167\frac{1}{2}$ [g], containing an intimation, 1. Of a way of preparing a fit

[f] Letter-book, vol. v. p. 123. It is printed in the Philos. Transact. vol. vi. n° 79. p. 3052. for January, $167\frac{1}{2}$.

[g] Letter book, vol. v. p. 142.

metalline

3

metalline matter for reflecting concaves. 2. Of a considerable philosophical discovery, which he intended to send to the Society to be considered of and examined. It was as follows:

"Understanding by your last, that some of the fellows of the honourable Society, "in order to a bigger reflective telescope, are devising a fit metalline matter, let "me presume to give them this caution, that whilst they seek for a white, hard, "and durable metalline composition, they resolve not upon such an one, as is full of "small pores, only discoverable by a microscope: for tho' such an one may, to "appearance, take a good polish, yet the edges of those small pores will wear "away faster in the polishing than the other parts of the metal; and so however "the metal seem polite, yet it shall not reflect with such an accurate regularity as "it ought to do. Thus tin-glass, mixt with ordinary bell-metal, makes it more "white, and apt to reflect a greater quantity of light; but withal its fumes raised "in the fusion like so many aerial bubbles fill the metal full of those microscopical "pores: but white arsenic both blanches the metal, and leaves it solid, without any "such pores, especially if the fusion hath not been too violent. What the stellate "regulus of Mars (which I have sometimes used) or other such like substance "will do, deserves particular examination. Let me add further this intimation, "that putty, or other such like powder, with which it is polished, by the sharp "angles of its particles fretteth the metal, if it be not very fine, and filleth it full "of such small holes as I speak of. And therefore care must be taken of that "before judgment be given, whether the metal be throughout the body of it po-"rous or not.

"I desire, that in your next letter you would inform me, for what time the "Society continue their weekly meetings; because if they continue them for any "time, I am purposing them, to be considered of and examined, an account "of a philosophical discovery, which induced me to the making of the said tele-"scope; and I doubt not but will prove much more grateful than the communi-"cation of that instrument, being, in my judgment, the oddest, if not the most "considerable detection, which hath hitherto been made in the operations of na-"ture."

It was ordered, that Mr. Newton be thanked for his respect to the Society, and desired to let them know the proportions of the ingredients mentioned by him in his letter, arsenic and bell-metal; as also to impart to them the intimated discovery, as soon as he conveniently could.

Mr. Oldenburg read an account of a method of reviving animals drowned, in a letter to him from Dr. Hierne, a member of the Society, dated at Paris [b]. It was as follows:

"Having the honour to be a member of the illustrious Royal Society, I think "myself highly obliged to contribute what I can (though that can be but very

[b] Letter-book, vol. v. p. 67.

"little)

“ little) to the advance of their deſign. Though I have met with many curious
“ things, ſince my leaving England, yet I do not think them of importance
“ enough to preſent you with them; yet among them there is one thing, which
“ ſeems philoſophical enough and uſeful, if it could be brought to perfection and
“ into practice; that is, a way of reviving animals drowned, and that even after
“ they have been ſo, many hours. Here is one, that hath already made ſome
“ experiments concerning it. He made one, two or three months ago, which
“ ſucceeded in part. He took a dog, which having been drowned three days be-
“ fore, he made him to ſtir, though he brought him not quite to life again. It
“ was thought, that the reaſon, why he revived not altogether, was, becauſe the
“ dog had not been drowned in a river, but in a barrel, in which there was not
“ air enough to entertain life. This perſon maketh as yet a ſecret of his art;
“ but, I know, that in Finland and the neighbour countries it often comes to
“ paſs, that perſons, after they have been drowned two or three days, come
“ to life again. The main of the art conſiſts in the manner of drawing them out
“ of the water; about which I once diſcourſed largely with Monſ. Leyonberg,
“ the reſident of Sweden. In ſhort, it is this; that as ſoon as they have found
“ the perſon drowned, they draw him up very gently towards the ſurface of the
“ water, yet without bringing him haſtily into the air, to the end, that the raw
“ and groſs air may not get into him impetuouſly, and mingle with the water,
“ that is yet in the lungs; and leaſt, when the circulation of the blood comes to
“ be made again, the blood does not burſt the pulmonic veins, and ſo by the
“ crudity of the water, the vital warmth of the heart be not extinguiſhed:
“ whence it is obſerved in almoſt all drowned perſons, that are not drawn up
“ with that care, that the blood iſſues out of their mouth; which alſo happened
“ to the dog above mentioned; and when that caſe happens, there is not any
“ hope left of recovery. Wherefore the Finlanders having found the drowned
“ body, they draw him gently towards the ſurface of the water, and pre-
“ ſently cover him with a thick cover, and carry him into a hot ſtove,
“ where they put him upon a tun, and roll him gently to and fro, beginning firſt
“ with a very gentle motion, and afterwards by degrees increaſing the agitation,
“ whereby the water comes out of the mouth, noſe, and other orifices. And the
“ water being come away, and the pores opened, they rub the patient with hot
“ linen cloths, and uſe other fomentations, and then he begins to live again little
“ by little; and after ſome days or weeks (ſome ſooner, ſome later, according to
“ the force and conſtitution of the patient) they often are revived. It is ob-
“ ſerved, that thoſe, which thus eſcape, have loſt much of their vivacity, and that
“ they are afterwards almoſt always very dull, and that their memory is much im-
“ paired; which doubtleſs happens, becauſe the blood hath been plentifully caſt
“ into the head, and ſo diſorders the functions of the brain and ſpirits: to which
“ alſo may much contribute the coldneſs of the water entering into the noſe and
“ ears. But to return to the Pariſian artiſt, I do not yet know the means he
“ uſeth. I know only thus much, that he maketh uſe of clyſters, the better to
“ evacuate the water out of the bowels, which is not practiſed in the countries I
“ ſpoke of. This I know alſo, that he puts aſhes over the body, which doubt-
“ leſs he doth in imitation of what happens to flies, which are revived being
“ put in warm aſhes, after they have been drowned. Perhaps the aſhes may open
“ the

" the pores, and by their ſharpneſs may ſomewhat irritate the ſpirits, and bring
" them into motion again, the which yet, I think, may be better done by rub-
" bing with hot linen cloths.

" Before I conclude my letter and this account, I cannot but impart to you one
" thing more relating to this matter: Monſ. Oxhuwen, a Swediſh gentleman,
" very judicious and of great veracity, hath lately aſſured me, that ſome years
" ago, in the pariſh of Botnare in Sweden, the place of his reſidence, ſituate
" three leagues from Joukoping, a youth of fifteen or ſixteen years of age fell
" into the water when he was fiſhing, whence he was not drawn up till the third
" day after, and was recovered after the manner above deſcribed. And he added,
" that the lad ſaid, he had lain in the water without any trouble, hearing what
" was ſaid concerning him above water, and relating what his father had ſaid in
" ſeeking him. But he lived but ſix months after this accident, and was quite
" changed in his temper, being very melancholy; whereas before he was very
" cheerful. Another Swede aſſured me likewiſe, that being at Upſal he fell alſo
" into the river, whence he was drawn up an hour after, having heard, during
" the time, all what had been ſaid on the river-ſide.

" I could tell you many more hiſtories of this nature, but I would not be tedi-
" ous. You know what Stiernhelm, a Swediſh counſellor, one of the Royal
" Society, wrote to you a year ago, of a gardener, that was fallen into the water
" near that town, and how he was revived a good while after.

" I ſhall only add, that though thoſe, that are hanged and ſtrangled, die ſoon,
" yet that is another thing, becauſe there wants not all air to a drowned animal,
" as there doth to one that is ſtrangled. And although the lungs, by reaſon
" of the abundance of water got in, cannot perform their function; yet ſince
" the water cannot enter into the heart, nor the arteries and veins, the circu-
" lation of the blood is not quite ſtopped, but only hindered; ſo that it cannot
" be made but very ſlowly and inſenſibly, after the manner as in apoplexies or
" hyſterical ſuffocations. If the paſſage of the nouriſhment is obſtructed, and
" that the chyle cannot paſs, it is to be conſidered, that the vital heat alſo is
" very weak in this caſe, and conſequently that the conſumption of the blood,
" ſpirits, and nutriment is but ſmall, and in a manner the ſame as it is in the
" bears of Lapland and Finland, which ſleep whole months without eating any
" thing. Mean time, I acknowledge, that it is quite another thing, when per-
" ſons fall into the ſea, or into foul and troubled waters, the pores whereof are
" filled with other parts, and conſequently cannot contain ſo much air as freſh
" and clear water doth."

It was ordered, that the phyſicians of the Society and other members ſhould be deſired to make experiments of this kind upon dogs.

Dr. Brown preſented a remarkable kind of fine black, ſent to his father, Sir Thomas Brown, out of Iceland, ſeeming to agree with the *lapis obſidianus* men-

mentioned by PLINY, out of which the four elephants in the Temple of Concord, and the statue of MENELAUS found by TIBERIUS in Ægypt, were made.

It was delivered to CHRISTOPHER COCKS the perspective-maker, to try whether it would be fit for reflecting concaves.

Dr. BROWN produced likewise a sort of small black stones, seeming to be black pebbles, found upon the ground in many places of Iceland: as likewise a sort of natural sulphur digged out of the earth in the same island, found in several places there, and at great distances from the burning Hecla.

Dr. WREN intimated, that his highness Prince RUPERT had a way of making black lead run like a metal in a mould, so as to serve for black lead again.

The president being desired to declare to the Society, whether he had considered of Mr. HOOKE's late proposition of bringing telescopes and microscopes, &c. to perfection, said, that he had not yet had time to examine it well; but, by what he had seen, he could not but have a good opinion of it.

This was seconded by Dr. WREN, who had also been made acquainted with it by the inventor.

The Society urged the president and Mr. HOOKE, that something might be undertaken in this matter, that might convince the world of the reality thereof.

Mr. HOOKE was put in mind of the experiment of forcing mercury and air through wood.

Feb. 1. The four foot telescope of Mr. NEWTON's invention was produced again, being improved since the last meeting. It was recommended to Mr. HOOKE, to see it perfected as far as it was capable of being.

Mr. HOOKE was put in mind to give, as soon as he could, a specimen of his great proposition of making telescopes, microscopes, &c. in perfection.

A paper sent to Dr. BROWN from his father, concerning a bulimia in a woman of one hundred and two years old, was read.

The experiments of reviving animals drowned were again recommended to the physicians of the Society, and particularly to Dr. TIMOTHY CLARKE, who promised, that he would do his part in making such trials.

Mr. VERNON's letters to Mr. OLDENBURG from Paris, January 9, 27, and 30, 167$\frac{1}{2}$ [k], containing an account of the mensuration of the earth by Mons. PICART, were read: as was also,

[k] Letter-book, vol. v. p. 99.

A let-

A letter of Mr. Flamstead to Mr. Oldenburg, dated at Derby, 23 December, 1671, was read, containing his promiſed Appendix of the moon's appulſes to ſome of the Peleiades, to be obſerved in the year 1672 [l].

Feb. 8. Five letters to Mr. Oldenburg were read:

1. Of Dr. Wallis, dated February 5, 167$\frac{1}{2}$, intimating, that from ſeveral late obſervations of his he conjectured, that the moon's perigee and apogee might much influence the riſing and falling of the mercury in the barometer. This was recommended to thoſe members of the Society, who had bareſcopes, for further obſervation.

2. Of ſignor Cornelio, in Italian, from Naples, of January 29, 167$\frac{1}{2}$ [m], declaring, that the ſtories related of the odd effects of the tarantula's ſtinging were in his opinion fictitious; and that, from many of his own obſervations, he was induced to believe, that without any preceding bite of that inſect, ſuch ſymptoms befal many of thoſe people who live in Apulia, a very dry country, and are often tormented with an exceſſive and long thirſt. He promiſed, within a ſhort time, to enlarge himſelf upon this ſubject, with many more obſervations [n].

3. Of Mr. Isaac Newton from Cambridge, 6 February, 167$\frac{1}{2}$, concerning his diſcovery of the nature of light, refractions, and colours; importing, that light is not a ſimilar, but a heterogeneous body, conſiſting of different rays, which had eſſentially different refractions, abſtracted from bodies through which they paſs; and that colours are produced from ſuch and ſuch rays, whereof ſome, in their own nature, are diſpoſed to produce red, others green, others blue, others purple, &c. and that whiteneſs is nothing but a mixture of all ſorts of colours, or that it is produced by all ſorts of colours blended together.

It was ordered, that the author be ſolemnly thanked, in the name of the Society, for this very ingenious diſcourſe [o], and be made acquainted, that the Society think very much of it, if he conſent to have it forthwith publiſhed [p], as well for the greater convenience of having it well conſidered by philoſophers, as for ſecuring the conſiderable notions of the authors againſt the pretenſions of others.

It was ordered alſo, that this diſcourſe be entered into the regiſter-book [q]; and that the biſhop of Saliſbury, Mr. Boyle, and Mr. Hooke be deſired to peruſe and conſider it, and bring in a report of it to the Society.

[l] It is printed in the Philoſ. Tranſact. vol. vi. nº 79. p. 3061. for January, 167$\frac{1}{2}$.

[m] Letter-book, vol. v. p. 114.

[n] Mr. Oldenburg, in his anſwer to ſignor Cornelio, dated 9th February, 1671, inſerted in the Letter-book, vol. v. p. 159, requeſted him to impart his obſervations to the Royal Society.

[o] Mr. Oldenburg's letter to Mr. Newton for this purpoſe is dated February 8, 167$\frac{1}{2}$, and entered in the Letter-book, vol. v. p. 157.

[p] It is printed in the Philoſoph. Tranſact. nº 80, p. 3075, for February, 167$\frac{1}{2}$.

[q] Vol. iv. p. 138.

4. Of Mr. Flamstead, dated at Derby, 5th February, $167\frac{1}{2}$ [r], containing ſome of his late obſervations concerning the ſatellites of Jupiter.

5. Of Dr. Hanneman, phyſician of Buxtehude in Germany, dated 3d January, $167\frac{1}{2}$, expreſſing his great eſteem of the Society, and deſiring their judgment on the matter of ſanguification, and how it is performed.

It was ordered, that he ſhould be thanked for his reſpect to the Society, and made acquainted, that it is not their cuſtom to be haſty in delivering their judgment in any philoſophical matters; but that all things of that nature are committed by them to obſervations and experiments frequently and carefully made.

Feb. 15. The minutes of the laſt meeting being read, and there occurring Dr. Wallis's obſervation about the more than ordinary hight of the mercury in the baroſcope at the time of the moon's perigee, Mr. Hooke mentioned, that by his obſervations that of the doctor did not hold, he having often remarked, that the quickſilver remained at almoſt one and the ſame hight for a long while, and even for months together in ſummer.

It was thought deſireable, that this matter might be farther obſerved with care by thoſe, who had baroſcopes.

The buſineſs of tarantula's likewiſe being again mentioned, and ſome of the members remarking, that it would be hard to accuſe of fraud or error Ferdinand Imperato and other good authors, who had delivered, from their own experience, ſo many miſchievous effects of the bite of tarantula's, it was ordered, that the ſecretary ſhould deſire to know of Dr. Cornelio, who denied ſuch effects, what he could ſay to the writings of thoſe famous men concerning this matter.

Mr. Hooke's conſiderations upon Mr. Newton's diſcourſe on light and colours were read. Mr. Hooke was thanked for the pains taken in bringing in ſuch ingenious reflections; and it was ordered, that this paper ſhould be regiſtred [s], and a copy of it immediately ſent to Mr. Newton: and that in the mean time the printing of Mr. Newton's diſcourſe by itſelf might go on, if he did not contradict it; and that Mr. Hooke's paper might be printed afterwards, it not being thought fit to print them together, leſt Mr. Newton ſhould look upon it as a diſreſpect, in printing ſo ſudden a refutation of a diſcourſe of his, which had met with ſo much applauſe at the Society but a few days before.

Mr. Hooke's paper was as follows:

" I have peruſed the diſcourſe of Mr. Newton about colours and refractions,
" and I was not a little pleaſed with the niceneſs and curioſity of his obſervations.
" But, tho' I wholly agree with him as to the truth of thoſe he hath alledged,

[r] Letter-book, vol. v. p. 155. [s] Regiſter, vol. iv. p. 148.

" as

" as having, by many hundreds of trials, found them so; yet as to his hypo-
" thesis of solving the phenomaena of colours thereby, I confess, I cannot see yet
" any undeniable argument to convince me of the certainty thereof. For all
" the experiments and observations I have hitherto made, nay, and even those
" very experiments, which he alledgeth, do seem to me to prove, that *white*
" is nothing but a pulse or motion, propagated through an homogeneous, uni-
" form, and transparent medium: and that colour is nothing but the disturb-
" ance of that light, by the communication of that pulse to other transparent me-
" diums, that is, by the refraction thereof: that *whiteness* and *blackness* are no-
" thing but the plenty or scarcity of the undisturbed rays of light: and that
" the two colours (than the which there are not more uncompounded in nature)
" are nothing but the effects of a compounded pulse, or disturbed propagation
" of motion caused by refraction.

" But, how certain soever I think myself of my hypothesis (which I did not take
" up without first trying some hundreds of experiments) yet I should be very glad
" to meet with one *experimentum crucis* from Mr. Newton, that should divorce me
" from it. But it is not that, which he so calls, will do the turn; for the same phæ-
" nomenon will be solved by my hypothesis, as well as by his, without any man-
" ner of difficulty or straining: nay, I will undertake to shew another hypothesis,
" differing from both his and mine, that shall do the same thing.

" That the ray of light is as it were split or rarified by refraction, is most cer-
" tain; and that thereby a differing pulse is propagated, both on those sides, and
" in all the middle parts of the ray, is easy to be conceived: and also, that differ-
" ing pulses or compound motions should make differing impressions on the eye,
" brain, or sense, is also easy to be conceived: and that, whatever refracting me-
" dium does again reduce it to its primitive simple motion by destroying the ad-
" ventitious, does likewise restore it to its primitive whiteness and simplicity.

" But why there is a necessity, that all those motions, or whatever else it be
" that makes colours, should be originally in the simple rays of light, I do not
" yet understand the necessity of, no more than that all those sounds must be in
" the air of the bellows, which are afterwards heard to issue from the organ-
" pipes; or in the string, which are afterwards, by different stoppings and strik-
" ings produced; which string (by the way) is a pretty representation of the shape
" of a refracted ray to the eye; and the manner of it may be somewhat imagined
" by the similitude thereof: for the ray is like the string, strained between the
" luminous object and the eye, and the stop or fingers is like the refracting sur-
" face, on the one side of which the string hath no motion, on the other a vi-
" brating one. Now we may say indeed and imagine, that the rest or streight-
" ness of the string is caused by the cessation of motions, or coalition of all vi-
" brations; and that all the vibrations are dormant in it: but yet it seems more
" natural to me to imagine it the other way.

" And I am a little troubled, that this ſuppoſition ſhould make Mr. Newton " wholly lay aſide the thoughts of improving teleſcopes and microſcopes by re- " fractions; ſince it is not improbable, but that he, that hath made ſo very good an " improvement of teleſcopes by his own trials upon reflection, would, if he had " proſecuted it, have done more by refraction. And that reflection is not the " only way of improving teleſcopes, I may poſſibly hereafter ſhew ſome proof " of. The truth is, the difficulty of removing that inconvenience of the ſplit- " ting of the ray, and conſequently of the effect of colours, is very great; but " yet not inſuperable. I have made many trials, both for teleſcopes and mi- " croſcopes by reflection, which I have mentioned in my Micrographia, but de- " ſerted it as to teleſcopes, when I conſidered, that the focus of the ſpherical con- " cave is not a point but a line, and that the rays are leſs true reflected to a " point by a concave, than refracted by a convex; which made me ſeek that by " refraction, which I found could not rationally be expected by reflection: nor " indeed could I find any effect of it by one of ſix foot radius, which, about ſe- " ven or eight years ſince, Mr. Reeve made for Mr. Gregory, with which I " made ſeveral trials; but it now appears it was for want of a good encheiria " (from which cauſe many good experiments have been loſt) both which conſi- " derations diſcouraged me from attempting further that way; eſpecially ſince I " found the parabola much more difficult to deſcribe, than the hyperbola or el- " lipſis. And I was wholly taken from the thoughts of it, by lighting on divers " ways, which in theory anſwered all I could wiſh for; tho' having much more " buſineſs, I could not attend to bring them into uſe for teleſcopes; tho' for mi- " croſcopes I have for a good while uſed it. Thus much as to the preamble; I " ſhall now conſider the propoſitions themſelves.

" Firſt then, Mr. Newton alledgeth, that as the rays of light differ in re- " frangibility, ſo they differ in their diſpoſition to exibit this or that colour: " with which I do in the main agree; that is, that the ray by refraction is, as it " were, ſplit or rarified, and that the one ſide, namely that which is moſt refracted, " gives a *blue*, and that which is leaſt a *red:* the intermediate are the dilutings " and intermixtures of thoſe two, which I thus explain. The motion of light in " an uniform medium, in which it is generated, is propagated by ſimple and " uniform pulſes or waves, which are at right angles with the line of direction; " but falling obliquely on the refracting medium, it receives another impreſſion " or motion, which diſturbs the former motion, ſomewhat like the vibration of a " ſtring: and that, which was before a line, now becomes a triangular ſuperfi- " cies, in which the pulſe is not propagated at right angles with its line of direc- " tion, but aſcew, as I have more at large explained in my Micrographia; and " that, which makes excurſions on the one ſide, impreſſes a compound motion on " the bottom of the eye, of which we have the imagination of *red*; and that, " which makes excurſions on the other, cauſes a ſenſation, which we imagine a " *blue*; and ſo of all the intermediate dilutings of thoſe colours. Now, that the " intermediate are nothing but the dilutings of thoſe two primary, I hope I have " ſufficiently proved by the experiment of the two wedge-like boxes, deſcribed " in my Micrographia. Upon this account I cannot aſſent to the latter part of

2 " the

" the propofition, that colours are not qualifications of light, derived from refrac-
" tions, or refections of natural bodies, but original and connate properties, &c.

" The fecond propofition I wholly allow, not exactly in the fenfe there meant, " but with my manner of expreffing it; that is, that part of the fplit ray, which is " moft bent, exhibits a blue, that which is leaft, a red, and the middle parts midling " colours; and that thofe parts will always exhibit thofe colours till the com- " pound motions are deftroyed, and reduced by other motions to one fimple and " uniform pulfe as it was at firft.

" And this will eafily explain and give a reafon of the phænomena of the third " propofition, to which I do readily affent in all cafes, except where the fplit ray " is made by another refraction, to become intire and uniform, again to diverge " and feparate, which explains his fourth propofition.

" But as to the fifth, that there are an indefinite variety of primary or original " colours, amongft which are yellow, green, violet, purple, orange, &c. and " an infinite number of intermediate gradations, I cannot affent thereunto, as " fuppofing it wholly ufelefs to multiply entities without neceffity, fince I have " elfewhere fhewn, that all the varieties of colours in the world may be made " of two. I agree in the fixth, but cannot approve of his way of explicating " the feventh. How the fplit ray being made doth produce a clear and uniform " light, I have before fhewed; that is, by being united thereby from a fuperfi- " cial motion, which is fufceptible of two, to a lineary, which is fufceptible of " one only motion; and it is as eafy to conceive how all thofe motions again ap- " pear after the rays are again fplit or rarified. He, that fhall but a little confider " the undulations on the furface of a fmall river of water, in a gutter, or the " like, will eafily fee the whole manner curioufly exemplified.

" The eighth propofition I cannot at all affent to, for the reafons above; and " the reafons of the blue flame of brimftone, of the yellow of a candle, the " green of copper, and the various colours of the ftars, and other luminous bo- " dies, I take to proceed from quite another caufe, eafily explained by my for- " mer hypothefis.

" I agree with the obfervations of the ninth, tenth, and eleventh, though not " with his theory, as finding it not abfolutely neceffary, being as eafily and na- " turally explained and folved by my hypothefis.

" The reafon of the phænomena of my experiment, which he alledgeth, is " as eafily folvable by my hypothefis as by his; as are alfo thofe, which are men- " tioned in the thirteenth. I do not therefore fee any abfolute neceffity to be- " lieve his theory demonftrated, fince I can affure Mr. Newton, I cannot only " folve all the phænomena of light and colours by the hypothefis I have for- " merly printed, and now explicate them by, but by two or three other very dif-

" fering

" fering from it, and from this, which he hath described in his ingenious discourse.

" Nor would I be underftood to have faid all this againft his theory, as it is " an hypothefis; for I do moft readily agree with them in every part thereof, and " efteem it very fubtil and ingenious, and capable of folving all the phænomena " of colours: but I cannot think it to be the only hypothefis, nor fo certain as " mathematical demonftrations.

" But grant his firft propofition, that light is a body, and that as many co- " lours as degrees thereof as there may be, fo many forts of bodies there may " be, all which compounded together would make white; and grant further, " that all luminous bodies are compounded of fuch fubftances condenfed, and " that whilft they fhine, they do continually fend out an indefinite quantity there- " of, every way in orbem, which in a moment of time doth difperfe itfelf to the " utmoft and moft indefinite bounds of the univerfe; granting thefe, I fay, I " do fuppofe there will be no great difficulty to demonftrate all the reft of his " curious theory: though yet, methinks, all the coloured bodies in the world " compounded together fhould not make a white body, and I fhould be glad " to fee an experiment of that kind done on the other fide. If my fuppofition " be granted, that light is nothing but a fimple and uniform motion, or pulfe " of a homogeneous and adopted (that is a tranfparent) medium, propagated from " the luminous body in orbem, to all imaginable diftances in a moment of time, " and that that motion is firft begun by fome other kind of motion in the lu- " minous body; fuch as by the diffolution of fulphureous bodies by the air, or " by the working of the air, or the feveral component parts one upon another, " in rotten wood, or putrifying fifh, or by an external ftroke, as in diamond, fu- " gar, the fea-water, or two flints or cryftal rubbed together; and that this " motion is propagated through all bodies fufceptible thereof, but is blended or " mixt with other adventitious motions, generated by the obliquity of the ftroke " upon a refracting body; and that, fo long as thofe motions remain diftinct in " the fame part of the medium or propagated ray, fo long they produce the fame " effect, but when blended by other motions, they produce other effects: and " fuppofing, that by a direct contrary motion to the newly impreffed, that ad- " ventitious one be deftroyed and reduced to the firft fimple motion; I believe " Mr. NEWTON will think it no difficult matter, by my hypothefis, to folve all the " phænomena, not only of the prifm, tinged liquors, and folid bodies, but of " the colours of plated bodies, which feem to have the greateft difficulty. It " is true, I can, in my fuppofition, conceive the white or uniform motion of " light to be compounded of the compound motions of all the other colours, " as any one ftrait and uniform motion may be compounded of thoufands of " compound motions, in the fame manner as DESCARTES explicates the reafon " of the refraction; but I fee no neceffity of it. If Mr. NEWTON hath any " argument, that he fuppofes an abfolute demonftration of his theory, I fhould be

"very glad to be convinced by it, the phænomena of light and colours being, in "my opinion, as well worthy of contemplation, as any thing else in the world."

Monf. SCHROTER prefented for the repofitory a glafs, which by a metallic body he had tinged red, fo as that it differs not from the antient red glafs. He affirmed that this manner of tinging is neither difficult nor chargeable. His paper accordingly was ordered to be regiftred [t], and was as follows:

"This red glafs, made by the help of a metallic tincture, doth in its colour "or elfe not differ from the antient red glafs, and is as good as the fame, if "not better: then the colour of this glafs can be heightened and made darker. "The manner of tinging it is not difficult, but it may be quickly prepared with-"out great labour or danger: the charges are likewife fmall, fo that, with a fmall "quantity of tincture, much glafs may be tinged; whether an hundred times more, "or a greater quantity, I cannot well fay, for that I never took notice of very "accurately. As for the bignefs of the glafs, it is no matter of what bignefs "it be; for a table of glafs of that colour may be made, though it be fome "feet long or broad, without an efpecial furnace or fire."

Mr. HOOKE was put in mind of the fix foot tube of Mr. NEWTON's invention, and of bringing in a fpecimen of the effect of his own propofition.

February 22. Mr. HOOKE made an experiment, to fhew, that, befides the flame and fmoke of a candle, there is a continual ftream rifing up from it, diftinct from the air; concerning which, he faid, that he conceived, that as the action of the air upon the parts of the candle heated, or the diffolution of them, was the flame; fo the compofition of the air, and the relict of the effluvia of the parts of the candle diffolved thereby, made this ftream, which continually afcended, and kept itfelf diftinct from the air.

Mr. NEWTON's letter to Mr. OLDENBURG, dated at Cambridge, February 20, $167\frac{1}{2}$ [u], was read, promifing an anfwer to Mr. HOOKE's obfervations upon his new theory of light and colour. It was as follows:

"I received yours February 17, and, having confidered Mr. HOOKE's obferva-"tions on my difcourfe, am glad, that fo acute an objector hath faid nothing that "can enervate any part of it: for I am ftill of the fame judgment, and doubt "not, but that upon feverer examinations, it will be found as certain a truth as I "have afferted it. You fhall very fuddenly have an anfwer.

"In Monf. HUGENIUS's letter there are feveral handfome and ingenious "remarks: and what he faith concerning the grinding parabolical conoids by "geometrical rules, I do, with him, defpair of; but I doubt not but that the "thing may be, in fome meafure, accomplifhed by mechanical devices."

[t] Regifter, vol. iv. p. 125. [u] Letter-book, vol. v. p. 166.

Signor

Signor MALPIGHI's letter of 1ſt February, 167½, from Bologna, was read, intimating, that he had tranſmitted a diſcourſe, and ſome ſchemes, concerning ſome late obſervations of his upon eggs, which he ſubmitted to the examination and cenſure of the Society.

This diſcourſe being opened, and read in part, it was found, that that philoſopher had, by very careful and diligent microſcopical obſervations, diſcovered that, in prolific eggs, before, as well as after, incubation, the firſt rudiments of the principal parts of the chick are actually contained; but that, in addle eggs, inſtead of ſuch a ſubſtance, there is only found a globous, aſh-coloured body, like a mola, &c. It was ordered, that this diſcourſe, and the figures thereunto belonging, being by the author ready fitted for the preſs, ſhould forthwith be committed to the printers of the Society to be printed; and that particular care ſhould be taken by the ſecretary, of having the ſchemes exactly ingraven by the beſt ingraver to be had in London: as alſo that ſolemn thanks ſhould be returned to the learned and obliging author for this ingenious piece, and for his ſingular reſpect to the Society.

The ſecretary having foreſeen, that ſuch an order would be given, and therefore drawn up proviſionally, a letter for that purpoſe, it was ordered to be read, and being approved of [x], to be ſent away by the firſt opportunity.

Mr. HOOKE was deſired to produce at the next meeting the experiment of repreſenting a blue and red colour in two wedge-like boxes.

February 29. The experiment exhibited at the laſt meeting, to ſhew the ſteam about the flame of a candle diſtinct from the ſmoke and air, was repeated, and proved ſatisfactory. Mr. HOOKE was ordered to give an account in writing of the manner of repreſenting this experiment.

He propoſed a way for a very ſpeedy conveyance of intelligence from place to place by the ſight aſſiſted with teleſcopes, to be employed on high places, by the correſpondents uſing a ſecret character, proportioned in bigneſs according to the diſtance at which they are to be ſeen, &c.

The paper of this propoſition, and the particulars of the manner of practiſing it, were read, but not left by Mr. HOOKE to be regiſtered, but taken away by him.

It was ordered, that ſome experiment ſhould be made of this propoſition at the next meeting; which Mr. HOOKE promiſed to do.

Signor MALPIGHI's diſcourſe concerning his new diſcoveries in the egg being again mentioned, Dr. CROUNE ſaid, that he had alſo found ſome ſuch thing as the rudiments of a chick in the egg before incubation.

[x] It was dated February 22, 167½, and entered in the Letter-book, vol. v. p. 167.

The

The bishop of Chester desired, that notwithstanding this, Signor MALPIGHI might have the honour of this discovery, since Dr. CROUNE had never brought into the Society an account, or a figure of this discovery, as Signor MALPIGHI had now sent to them an accurate description of this discovery, accompanied with many very neat, and laborious schemes.

The bishop of Salisbury moved, that the observations of both Dr. CROUNE and Signor MALPIGHI might be printed.

Dr. CROUNE gave an account of an embryo of six weeks old, of the bigness of a bee, which, being put into spirits of wine, the spirit did so penetrate the amnion, that the colliquamentum was thereby precipitated. He promised to produce this embryo at the next meeting.

Dr. WALTER NEEDHAM communicated a letter from Mr. JOHN TEMPLER, dated at Braybrook, 8th January, 167½ [y], giving an account of a dog rendered ricketty and dwarfish by washing him in brandy; and of another young dog, who having brandy given him to drink every morning, was brought to a violent and constant asthma.

Mr. OLDENBURG read a letter to him from Mr. LISTER, dated at York, 24th February, 167½ [z], containing his sense of what Signor CORNELIO had written from Naples, about the fictitiousness of the stories recorded of the mischievous effects of the biting of tarantulas. The letter was as follows:

" As for the further account concerning the tarantula of Signor CORNELIO at " Naples, I received it in Italian, as you was pleased to communicate it to me; " and since you desire my thoughts upon this matter; I will briefly make some " reflexions upon some of the particulars, and explain thereby the quære, that " gave the occasion.

" It is here affirmed, that the tarantula is a phalangium; which yet does not " plainly appear; possibly it may, when the author shall please to give us his " more particular observations, or transmit any of the animals themselves. *To " be *, diversly painted with diversity of colours, to live in holes of the earth*; " are notes common to most sorts of spiders, even with us. It is very necessary, " that great heed be taken of the characteristical notes we gave you, and by " which we know phalangia from all other tribes of spiders; for in this con" sists (at least in my judgment) the discovery of the nature and effects of " the tarantula.

" We had, undoubtedly, been in the dark still, but for that one chance note " of PLINY, lib 11. c. 24. viz. *assultim ingredi*; and had never known what the " antients had meant by their phalangia: and yet, having observed that skipping

[y] Letter-book, vol. v. p. 148. [z] Ibid, p. 172.

" motion in two or three sorts of our English spiders, we found, that all those, which " had that peculiar motion, agreed too in the senary number of eyes, not to mention " other distinguishing marks; those two being enough to reduce them to order. " Now then, it being the sole property of this tribe of spiders to move in going, " as though they danced, and therefore to be (for kind) those, which the antients " called *phalangia*, and whose biting they so much dreaded; I thought it very " material to enquire, whether the tarantula was not one of them, that is, " whether the tarantulæ go by skips, and have six eyes only, &c.?

" To tell you the truth, I had some reason to question this; not but that the " phænomena, or the effects of that mischievous bite, if really true, did un- " doubtedly depend (in my thoughts) upon the nature of the animal; but that " I had seen the spider brought from Rome, by the name of tarantula, and yet " whose figure, as I remember, shewed it plainly to be of another tribe, and no " phalangium. Again, because some late authors, that I had seen of this matter, " had given us the cut, or figure, of a *reticulum orbiculatum*, or wheel-net, with " a tarantula in it, which, in truth, is as an improper a thing (if a phalangium) as

" Delphinum Sylvis appingere ——

" this tribe having that in common with some other tribes of spiders, that they " scorn nets, and hunt openly, and take their prey by ambush and agility of " body. For an elegant description of their hunting, I refer you to Mr. Evelyn " in Mr. Hooke's Micrographia; where also I observe to you, by the by, that " that grey phalangium, there mentioned, is exceeding common all over England " (where I have been) as well as at Rome.

" We may well expect, from the ingenuity and diligence of Signor Cornelio, " the full clearing of this matter; we being already beholden to him for that " other rarity of his native soil, *manna*, which he hath put beyond exception, to " be a spontaneous exudation of the ash tree. See the experiment registered, as " he himself penned it, in a letter to Mr. Wray, *Catalog. Plant. Angl. in* " *Fraxino.* However, in the mean time, I may deserve your pardon, if I pre- " possess you with my opinion. I agree with him, that the matter will probably, " when thoroughly examined, not prove, not only as the vulgar is persuaded, " but not as authors write neither: and yet, he must excuse me, if I think it " will prove more than a meer fiction, and that those strange accidents, which " the *attarantati* are said to suffer, are not to be attributed to the great drought " of the country and thirst only, but possibly to the bite of a certain animal too."

March 7. An experiment was made of the method proposed by Mr. Hooke at the last meeting, of conveying intelligence from place to place, which was performed from Arundel-house garden to a boat lying near the shore on the other side of the Thames, by letters of a foot long, and glasses of two feet long, the distance being about half a mile.

The

The contrivance was applauded as very ingenious, and the author desired to make more tryals of it at greater distances.

The president objected, that the use of it would be often hindered by hazy weather.

Others intimated, that the greatest difficulty in the practice would be in proportioning the glass and the letters, viz. at what distance a glass of such or such a length shall discover characters of such and such a bigness.

Dr. King produced some galls of oak, seeming to him to be a fruit: but many of the members thought them to be excrescences caused by insects.

Sir Robert Moray mentioned, that a whole kennel of dogs belonging to his Royal Highness the Duke of York, which had been bitten by a mad dog, were lately cured by a certain herb, called *stellaria*, or the star of the earth.

Mr. Oldenburg produced a paper, importing, that Monf. Pecquet had lately made a new discovery between the *ductus thoracicus* and the inferior *vena cava*; which was ordered to be read at the next meeting.

Mr. Hooke promised to shew at the next meeting something having neither reflexion nor refraction, and yet diaphanous.

March 14. Dr. Tillotson was admitted fellow.

Mr. Cock was ordered to make, for the use of the society, a telescope of Mr. Newton's invention, of the length of four or five feet; which he promised to have ready within a fortnight.

He being put in mind of making a large burning concave, was advised to contract with the founder for one of a certain size, at a certain price, on condition of its being without fault: which he promised likewise to endeavour to do.

Mr. Hooke brought in an account of an experiment shewn before the society, February 29, and designed to prove, that the substance of a candle, or lamp, is dissolved by the air, and the greatest part thereof reduced to a fluid of the form of air. This paper was ordered to be registered [a], and was as follows:

"I took a large concave reflecting glass, or a large convex refracting glass, and "so placed it in respect to my eye, that a candle set at a certain distance beyond "the refracting glass, or between the eye and the superficies of the reflecting "glass, enlightened the whole area of the said glasses in respect to the eye. "Then continuing to keep the eye in that place, where the area of the said

[a] Register, vol. iv. p. 126.

" glaſſes appeared to be wholly filled with the flame of the candle, I cauſed another
" candle to be placed very near the ſaid glaſſes, between the eye and the glaſs;
" or beyond alſo, if I made uſe of the refracting glaſs. Then looking ſtedfaſtly
" at the flame of this laſt candle, it was very plain to be perceived, that the
" flame thereof was encompaſſed with a ſtream of liquor, which ſeemed to iſſue
" out of the wick, and to aſcend up in a continual current, or *jet d'eau*, to keep
" itſelf intire, and unmixt with the antient air, notwithſtanding that it was a
" conſiderable way carried above the aforeſaid flame. It was further very plain,
" that the ſaid diſtinct fluid did make ſeveral turnings, whirlings, or vortices in the
" ambient air, as it aſcended higher and higher, and by degrees mixed itſelf with
" the ambient air. It was yet further obſervable, that the ſhining flame was
" placed in the middle of this *jet d'eau*, at the lower end thereof; but that it
" did not aſcend proportionally in height to the height of the jet d'eau; that,
" where the tip of the flame ended, there aſcended up a ſmall line, of an opacous
" body, or ſmoke, which, to a good height above the flame, kept the middle
" of the ſtream. The manifeſtation of this phœnomena was from the differing
" refractions of the body of the jet d'eau from that of the ambient air: for the
" flame of the firſt candle being but ſmall, and placed at a conſiderable diſtance
" from the refracting, or reflecting glaſs, the ſmalleſt variation in the refraction
" of the medium between the firſt glaſs and the eye cauſed the darkneſs to inter-
" mix with the light; ſo to exhibit the appearance of the heterogeneous jet d'eau.
" This jet d'eau I ſuppoſe to be nothing elſe but the mixture of the air with the
" parts of the candle, which are diſſolved into it in the flame; for the air being
" (as I have elſewhere proved) the univerſal menſtruum, or diſſolvent, of all
" ſulphurous bodies, and the action of diſſolution in moſt bodies producing heat
" and light; it is manifeſt by the flame, that there is ſuch a ſolution, and it is
" not probable that the body ſo intermixt, ſhould immediately ſo perfectly in-
" termix itſelf with the reſt of the air, as not to appear, for a time, diſtinct
" from it, though it doth afterwards intermix itſelf with the reſt of the air.
" The reaſons why this mixt body (which certainly is otherwiſe heavier than
" the air, and ſo ought to deſcend) doth, notwithſtanding, aſcend with great
" ſwiftneſs, is firſt, from the aſcent of the flame in the middle; and next, from
" the extraordinary rarefaction of the ſame, by the ſame nearneſs and centrality
" of the flame and heat; whereby it is made much lighter than the ambient
" air. A phænomenon not much unlike this may be produced by ſeveral bodies
" diſſolved in oil of vitriol, wherein all the appearances, but light, are very
" perfectly repreſented."

Mr. Hooke promiſed to exhibit at the next meeting, an experiment to ſhew a phænomenon not unlike this, to be produced by ſeveral bodies diſſolved in oil of vitrol.

He ſhewed a phænomenon in a bubble raiſed by water and ſoap, wherein there appeared ſomething on water which had neither reflection nor refraction, and yet was diaphanous. He was deſired to bring an account of this in writing, with his thoughts upon it.

Dr. Croune produced the little fœtus of six weeks old in spirit of wine, mentioned by him at the meeting of February 29.; and it appeared, as if the spirit had penetrated the bag of this fœtus, and precipitated the colliquamentum thereof to the bottom of the bag.

He likewise gave in his Latin discourse concerning the conformation of a chicken in the egg; which was ordered to be read at the next meeting, being too long to be read at the present.

Mr. Oldenburg read the letter from Paris, produced by him at the preceding meeting, concerning a discovery lately made there by Monf. Pecquet, of a communication between the *ductus thoracicus* and the inferior *vena cava* [b].

March 21. There was read a letter of Mr. Hevelius to Mr. Oldenburg, dated at Dantzick, 9th March, 167½ [c], giving notice of a comet observed by him in Andromeda for several days, mornings and evenings, ever since the 2d. of March; and mentioning that he had again seen the new star under the head of the constellation of the Swan.

This letter having been communicated to Mr. Hooke some days before this meeting, he said, that he had not hitherto discovered any comet.

It was ordered, that notice should be given of this phænomenon by the secretary, to some persons in both the universities for observation, and particularly to Dr. Wallis and Mr. Newton.

There was read a letter of Mr. Newton to Mr Oldenburg, dated at Cambridge, March 19, 167½ [d], containing several particulars relating to his new telescope.

Mr. Boyle communicated a paper of his, containing an account of nineteen observations made by himself on shining flesh, both veal and pullet, especially the former, in one piece of which he had reckoned distinctly above twenty several places, which all shone, more or less, without finding by the smell the least degree of stink, whence to infer any putrifaction; which observations were ordered to be registred [e].

This paper occasioned some discourse concerning observations made by others of the like phænomena, not only in flesh, as in lamb-flesh, mentioned by Fabricius ab Aquapendente, but also in oisters, the sea-water, &c.

[b] This paper was probably that printed in the *Journal des Sçavans* of Feb. 8, 1672. See Philos. Transact. vol. vii. n° 85. p. 5007.

[c] Letter book, vol. v. p. 182. It is published in the Philos. Transact. vol. vii. n° 81. p. 4017.

[d] It is printed in the Philos. Transact. n° 81. p. 4009.

[e] Register, vol. iv. p. 130. They are printed in the Philos. Transact. vol. vii. n° 89. p. 5108. for December, 1672.

March

March 28, 1672. There were read the answers given in by the lord HENRY HOWARD of Norfolk, to the inquiries concerning Barbary, formerly recommended by the Society to his lordship, when he went ambassador from the king to the emperor of Morocco.

After this paper was read, his lordship declared to the Society, that he went not himself, for reasons known, to Morocco; but that an ingenious person, one of his attendants in his voyage, Mr. BURGHILL, took care, by his order, to inform himself as well as he could, about the particulars contained in these inquiries; of which this was the result, which he desired the Society to accept of.

The Society returned to his lordship many thanks for his great favour and care of their concerns; and ordered, that this account should be entered in their Register-book [f]: as also, that Mr. BURGHILL should, in their name, be thanked by the secretary for his respect to the Society, in complying so carefully with their desires.

This paper was as follows:

" Q. 1. What is the temperature of the air?

" A. It is so hot in the latter end of August, that it melted chocolate-cake, " and resin of jalap; the latter being dried and grossly powdered. And the air " is withal so gross and hazy, that the sun never shined out, whilst we were there, " before nine in the morning, or after four in the evening, unless there had " been a brisk gale of wind the day before.

" Q. 2. What diseases the inhabitants are most subject to?

" A. Fevers, (which they call calentures one with another) fluxes, and some " of them with blood, the king's-evil, the pox, and films over their eyes, both " very frequent.

" Q. 3. Whether it be true, that those in Numidia, in the land of Dates, " live long, though they lose their teeth soon; and that the negroes are short-" lived, though their teeth continue sound to their death?

" A. Long in the hilly parts, the air being better there; yet they lose their " teeth by times, perhaps caused by the sharp sweetish juice of new dates, the great-" est part of their food; but they are shorter lived in the vallies, where the air is " gross and very suffocating in hot weather.

" Q. 4. Whether the venereal disease be seldom found in Numidia and " Lybia?

" A. A distemper well known over all Barbary.

[f] Vol. iv. p. 174.

" Q. 5.

" Q. 5. Whether in Barbary the plague is every tenth or fifteenth year, and " in Numidia not once in a hundred years, and in the land of the negroes not " known at all?

" A. Not known there at all.

" Q. 6. What medicines they use, and what poisons and antidotes are known " amongst them? Whether granum Nubiæ will kill in a lesser quantity than any " other known poison? Whether they have any poison, that kills by smell alone; " and if so, what that is?

" A. Athenna they esteem an universal medicine for man and beast; if it fail- " eth, they cauterize both, as our farriers do horses for the farcy. They have " several poisons that kill, but not by the smelling to them. Granum Nubiæ is " not known at Morocco.

" Q. 7. What is the composition called lhashish, of which it is said, that who- " soever takes an ounce of it, shall fall a laughing and sporting, and be like one " half-drunk, and be never amorous?

" A. Lhashish is the tops of green hemp, made with honey into an electuary, " but not above half an ounce at one time to be taken?

" Q. 8. What kind of root it is they call tanzargent, said to be an excellent " and lasting perfume?

" A. They have no perfume except musk and civet, and that very rare.

" Q. 9. What are the variations of the weather, according to the season of the " year, and the times of the day; what meteors the country is most wont to " breed, especially what winds it is subject to; whether any of them be stated and " ordinary; whether in October and November there be such snows betwixt " Mauritania and Numidia, that carts, horses, and trees are covered therewith?

" A. The rain happens most commonly in December and January. There " often are very great winds and thunder; sometimes they have rain in October, " which causes great plenty that year, and sometimes they have no rain for three " years together, which want of rain is the constant forerunner of dearth, and of " locusts in such an abundance, that they devour whatever is green, which be- " ing eaten by the people, brings a mortality not unlike the plague. In sum- " mer very stuffing heats with winds (much hotter than sun-beams) which blow " up the dust after the manner of those spouts often seen at sea: hail many " times of a prodigious bigness; falling stars in greater numbers than in Europe. " Levants only, which blow sometimes so far into th e continent as Morocco.

" Q. 10

"Q. 10. What obſervables there are concerning Mount Atlas; what is its "hight; whether it runs north and ſouth, eaſt or weſt; what mines it affords; "whether it has any ſprings upon the higheſt parts; whether it be true, that "there are ſome ſprings adjoining Mount Atlas ſo cold, that if one's hands be "any while continued therein, they are in danger of gangrening; what plants "are upon and about it, and whether any cockle-ſhells are found upon it?

"A. The Leſſer Atlas, when it comes near Morocco, ſeems more inclining "to a circle than a right line; and runs rather north and ſouth, than any other "points of the compaſs: the top continually covered with ſnow, which for the "moſt part appears above the clouds; many ſprings: but whether it be ſo cold "on the top of the hill, I know not.

"Q. 11. What is the nature of the ſoil, what grains, fruits, and other ve- "getables, particularly what trees, whoſe wood is conſiderable, the country af- "fords; to bring over ſome of the plants and ſeeds peculiar to that country?

"A. Fruitful, beyond belief; of colours various, but for the moſt part in- "clining to red; the ſoil extraordinary deep, and free from ſtones, unleſs it be "where it is altogether rocky. The ſorts of grains are barley, wheat, Indian "wheat, both white and red; another ſort of grain they call tuff-ſoot, the ſtalks "as big as a cane, and higher than a man on horſeback, the ſeed about the ſhape "of a kidney, white and big, as a black-cockle growing in corn, with which "they feed cattle. There are alſo grapes, almonds, olives, pomegranates, oranges, "lemons, dates, very great figs, citrons, all plentiful and large, except the "olives and almonds, which are ſmall, but very good: moreover, peaches, "apples, and pears, which they keep as we do medlars, till they are rotten; "water-melons, both white and red, muſk-melons, ſome whereof keep all the "winter, all very large; cucumbers of a great length, and crooked like a hunt- "er's horn; calibaſh both white and yellow, coloquintida, and a purple fruit "like a ſmall pumpion; and pumpions, called bern-hena, of taſte, when boiled, "not unlike a Jeruſalem artichock, which they boil with their meat; wild dates, "that grow like our fern, all over the country, being the leaf of which the flag- "brooms are made, bearing a fruit of a kind of deep orange colour, of the "bigneſs of a ſmall green walnut, growing in bunches near the root, of a bit- "teriſh taſte, and much eaten by the Moors in their journies.

"The vegetables being too many to be obſerved in a ſpeedy journey, are "promiſed to be ſupplyed by Mr. BATAM. There is cork, oak, and cedar, "of a pleaſing ſmell; a tree called lirz, not unlike our fir in the grain, ſmelling "ſomewhat like cypreſs; tamareſk, growing commonly about the rivers in great "quantities.

"Q. 12. What minerals the country is ſtored with; what quarries it affords, "and how the beds of ſtone lye; what clays and earths it yields; whether any

"medicated

" medicated earths; what ways they have of reducing their ores into metals;
" to bring over a ſpecimen of their ores, earths, clays, &c.

" A. There is copper, iron, lead, tin, white marble in great quantity; a kind " of whetſtone between rag-ſtone and oil-ſtone rock; a ſmall ſandy ſtone, both red " and white; a kind of talc, very large; a black ſparkling ſtone, that they make " mill-ſtones of; (the beds whereof lie neareſt north and ſouth) blue and red " clay; and a kind of fullers earth, wherewith the Mooriſh women waſh them- " ſelves; no medicated earth. They reduce their ores into metal by charcoal.

" Q. 13. What is obſervable in their rivers; whether they carry any golden " ſand in them; what is the quality of their waters; what kind of fiſh they " breed; their ſtore, bigneſs, goodneſs, haunts, ſeaſons, &c. Whether the rivers " running from Atlas upon the Lybian ſands are dried up in their paſſage; and " whether the Numidian rivers be dry when no rain falls from Atlas?

" A. There are no gold ſands on this ſide Atlas; the rivers few, rapid, " rocky, and deep; the water very heavy toward Fez. Fiſhes are mullets, a " kind of ſalmon, tortoiſe, and divers other ſmall fiſh, very well taſted, but " differing from thoſe of Europe: we were not ſo far as Lybia; no gold ſands " here, but what comes from Gambo.

" Q. 14. What lakes ponds, ſprings, and eſpecially mineral waters there are; their kinds, qualities, virtues, and how examined?

" A. No lakes, ponds only artificial in great mens gardens; there is one " very great and ſalt water between Saphy and Morocco, which being dryed up " every year by the ſun furniſhes that part of the country plentifully with ſalt: " between Fez and Aliazer there are ſeveral ſprings, making divers ſmall brooks, " of ſalt water, cruſted on the ſides with white ſalt, in places where the ſun hath " power, and riſing out of ſalt rocks, of browniſh and white mixture, in veins, " ſharper than bay ſalt, and very heavy. One day's journey from Aliazar to- " wards Fez is a ſpring of green water, ſtinking like the pumping of a ſtench " ſhip, the ſtream cruſted with a ſalt green, as common copperas, towards the " head of the ſpring, iſſuing out from the north ſide of a high hill. Their " virtues neither known nor looked after by theſe poor, lazy, and ignorant " people.

" Q. 15. What animals the country is ſtored with, both wild and tame; what " beaſts of prey they have, and the manner of catching them; what dogs they " have, and what games they are inclined to?

" A. There are lions, leopards, tigers, wild boars, jackals, foxes, a beaſt not " unlike a lion in ſhape, but leſs, and cowardly, digging men and women, as the " Moors tell, out of their graves, antilopes, apes, porcupines, very large ſnakes, " adders, chameleons, lizzards very great ones, oſtriches, eagles, vultures,

 " ſtorks,

" ſtorks, buſtards, cranes, falcons, kites, daws, pigeons, ringdoves, a ſort of " pigeons that ſtretch ſo exceedingly, that they are ready to fall backwards, and " ſome eat their meat behind them; Guinea-hens, partridges, heath-cocks, " ducks, curlews, teals, ox-eyes, larks, ſparrows, ſwallows, ravens, magpies; " but few camels, dromedaries, horſes, mules, aſſes, ſheep, and goats, which " they ſometimes ſhoot, and ſometimes hunt with curs and greyhounds with long " curled ears like ſpannels, and ſometimes ride them down. They play at cheſs " and draughts.

" Q. 16. Whether it be true, that the lions about Pietra Roſſa are ſo tame " as to go into the ſtreets and gather bones; and at Agla the lions ſo cowardly, " that they flie at the voice of a child?

" A. I can give no account of lions in theſe places in particular; but gene-" rally, the lions of Barbary are very great and fierce, coming often into the " ſtreets of towns ſeeking for prey, which they never do upon any dead body.

" Q. 17. Whether camels will travel many days without provinder and drink, " and ordinarily in travelling have no drink allowed them but once in three or " four days; and whether the camel called Ragnahill will travel 900 miles in " eight days; what manner of breeding their horſes?

" A. The camels upon neceſſity will travel three days without meat or water: " they ride horſes at a year old, handling them from their foaling; they tie them " by the forelegs with cords ſtaked down; they bring them water but once a " day; ther common food is ſtraw and barley; they teach them to ſtart, from " ſtanding ſtock ſtill, in a full career; they ſuffer them not to trot, but walk " very faſt, and ſtop ſuddenly, which they do with toſſing up their heads in the " air. Towards Fez, where the beſt and fleeteſt are, it is ſaid they feed them " only with milk, either of goat, aſs, cow, or camel. The breeding mares go " about with great about their necks, and are brought by night into " the d'warrs.

" Q. 18. Whether it be true, that there is ſuch a bird, that picks out the " worm from the crocodiles teeth, which having a little ſting in its head, cauſeth " the crocodile, when he would ſwallow it, to open his mouth and let it eſcape?

" A. No crocodiles in this part of Africa.

" Q. 19. Whether the dubb, a creature like a lizzard, about a cubit long, " and four inches broad, drinks no water at all, but dies, if water be poured into " his mouth?

" A. No ſuch beaſt as a dubb, only large lizzards, being in great plains, " where there was no water to be ſeen in many leagues of them; but we know " not whether they will die with water poured into their mouths.

" Q. 20. Whether the chamelion dropping a flime on ferpents heads kills " them ?

" A. We could hear of no fuch thing.

" Q. 21. What the oftrich feeds upon? To get one dried.

" A. Beans principally, and any fort of grain, flefh, if given them, and bread; " they will fwallow iron: they are rarities at Morrocco and Fez, brought for " prefents to the king only.

" Q. 22. As to the inhabitants, men and women, what are their inclina- " tions, diet, œconomy, conveniencies of life, their ftrength, agility, and fta- " ture, fhape ?

" Not anfwered.

" Q. 23. What is their way of educating their children ?

" Q. 24. What arts, practices, and ftudies they are given to; particularly, " what varnifhes they have amongft them; and what ways of tempering their " iron and fteel they ufe ?

" A. The beft are brought up to read and write, and fome to underftand " their laws, out of which they chufe their priefts and juftices; the reft illiterate " and idle, until fit for the plow or wars: they ufe no arts at all, few of them un- " derftand, or practife any trade, but leave them lazily to the Jews, that are worfe " than their flaves. Varnifhes they have none. They temper Spanifh fteel after " our manner, but not fo well; and for Damafco fteel, they underftand it not " at all; nor can they harden iron, that we could ever learn.

" Q. 25. Whether at Morocco they keep ftill their public arts of fcholars; " and if fo, what is therein performed ?

" A. Their academies are but their priefts teaching to read and write their " own language and law; thofe places they call univerfities being guilty of no " other learning.

" Q. 26. Whether they have chemifts among them; and if fo, what are " their abilities ?

" A. None at all, but Jews, and Chriftian flaves, that diftil brandy in jars.

" Q. 27. Whether any African writers give any account of the antient " Punic learning; and what books of geography, genealogy, hiftory, alchemy, " medicine, magic, &c. are extant amongft them; and, particularly, whether

" the Genealogies, ſaid by Leo Africanus to have been written by one Ivan " Racha, or Rachiock, and the Coſmography of one Bichri, mentioned by the " ſame author, are to be had; and whether one Margian, and another Jona " Caldin, have written ſtrange books concerning magick; and whether it be " true what the ſame Leo Africanus relates, that the fortune-tellers at Fez, by " pouring ſome drops of oil into a glaſs of water, can repreſent creatures, and " ſhew them to by-ſtanders, and ſpeaking to them, do receive anſwers by words " or ſigns?

" A. We can learn of no public libraries, or of bookſellers; what are, re- " main in private hands, and theſe are hiſtorical MSS. that we could ever learn " of. They uſe no fortune-telling, but by a kind of necromancy they pretend to " procure love or hatred.

" Q. 28. Whether there be any inſcriptions, or coins with characters, neither " Latin nor Arabic; and what coins, or rather inſcriptions are, or have been " found about Fez, and at Denſen; whether at Theleſſa there be many marble " pillars with ſentences and epigrams in Latin characters.

" A. We could hear of none, but at Fez have been found Roman coins long " ago. We never heard of Theleſſa.

" Q. 29. To inquire into any antient manuſcript, that may poſſibly have " been tranſlated out of the ancient Greek, either in geometry, aſtronomy, " phyſick, or chemiſtry.

" A. We could never get information of any ſuch.

" Q. 30. What manner of architecture they uſe? To make ſome deſigns " of their palaces and temples.

" A. Their buildings are generally mud-wall, about two feet thick, the roof " of the ſame, ſupported with ſmall rafters, and theſe covered ſometimes with " boards, ſometimes with canes, to ſuſtain the clay, without any other ceiling. " The houſes never exceed two ſtories, even in their cities; flat on the roof, " to walk on; the beſt built, for the moſt part, about a ſquare court; the " rooms about 30 feet long, between 8 or 9 feet over, 12 or 14 feet high; " having ſeldom any windows, or lights, but what comes in by the doors, that " are placed in the middle of each room, of 6 feet broad almoſt, to the roof, " opening with two leaves towards the court; the upper rooms, as theſe, only " opening to a narrow gallery, that goes round, ſupported with diſorderly, ex- " travagant pillars, made, when at beſt, of a whitiſh brick of near two inches " thick, and clay between every brick, thicker than the bricks, with which they " turn the arches of their doors, and intervals of their pillars. Their churches " are, for the moſt part, built of clay, ſome of ſtone, very low, with flat roofs, " paved

" paved with green tiles, as the houſes with divers colours. The ſteeples for the " moſt part like ours, but built of mud, except which are of ſquare ſtone."

Mr. Hooke brought in his written account of an experiment, made March 13, upon a bubble of water and ſoap, which was ordered to be regiſtered [f], and was as follows:

" By the help of a ſmall glaſs-pipe there were blown ſeveral ſmall bubbles out " of a mixture of ſoap and water; where it was obvious to obſerve, that at the " beginning to blow any of theſe bubbles, the orbicular film of water, which en- " compaſſed a globe of air, appeared white and clear, without any appearance of " colour; but after ſome time the film by degrees growing thinner, (part there- " of falling down, and part thereof evaporating and waſting into air) there ap- " peared upon the ſurface thereof all variety of colours, that may be obſerved in " a rainbow, beginning at firſt with a pale yellow, then orange, red, purple, " blue, green, and ſo onward, with other the ſame ſeries or ſucceſſions of colours: " in which it was farther notable, that the firſt and laſt ſeries of colours were " very faint, and that the middlemoſt order or ſeries was very bright and orien- " tal. After theſe colours had paſſed over their ſeveral changes, the film of the " bubble began to appear again white, and preſently up and down in this ſecond " white film there appear ſeveral holes, which by degrees increaſe and grow big- " ger, and ſeveral of them break into one another, till at length they become very " conſpicuous and big. It is ſtrange to obſerve, how thoſe holes will, by the " blowing or moving of the ambient air, be carried up and down upon the en- " compaſſed globe of air, and yet the bubble remain in its orbicular form with- " out falling. It is yet further ſtrange, that after this, when the bubble breaks, " its breaking is with a kind of impetus or crack, diſperſing the parts in a kind " of powder or miſt. It is yet further ſtrange, that thoſe parts of the bubble, " which thus appear like holes through it, by the moving up and down upon " the ſurface of the aerial globe will change its form, and from a circular " be made eliptical, or any other undulated or waved form, in the ſame man- " ner as any of the colours, that are viſible on the bubble. It is yet more ſtrange, " that though it is moſt certain, that both the incompaſſing and incompaſſed " air have ſurfaces, yet by no means, that I have yet made uſe of, will they " afford either reflection or refraction, which all the other parts of the incom- " paſſed air do. It is pretty hard to imagine, what curious net or inviſible body " it is, that ſhould keep the form of the bubble, or what kind of magnetiſm it " is, that ſhould keep the film of water from falling down, or the parts of in- " cluded and including air from uniting. The experiment, though at firſt thought " it may ſeem one of the moſt trivial in nature, yet as to the finding out the na- " ture and cauſe of reflection, refraction, colours, congruity and incongruity, " and ſeveral other properties of nature, I look upon it as one of the moſt in- " ſtructive: of which more hereafter perhaps."

[f] Vol. iv. p. 128.

He

. He made an experiment of diffolving fal-nitre in common water, whereby was caufed a ftream compofed of water and of the particles of nitre diffolved therein; which ftream was here defcending, as in a former experiment a ftream or fluid produced by a candle diffolved by the air afcended.

He was defired to bring in the defcription of it in writing.

There was read a letter of Mr. NEWTON to Mr. OLDENBURG, dated at Cambridge, 26th March, 1672 [g], containing fome more particulars relating to his new telefcope, efpecially the proportions of the apertures, and charges for feveral lengths of that fort of telefcope.

Mr. OLDENBURG communicated a relation, lately printed at Paris, concerning the return of a great permanent fpot in the planet Jupiter [h], making its periodical revolution with the greateft regularity and fwiftnefs hitherto known in the heavens; viz. in nine hours and fifty fix minutes, obferved by Signor CASSINI.

It was looked upon as a remark of confiderable importance though it was at the fame time taken notice of, that the fame fpot had been difcovered by Mr. HOOKE in May 1664, before any thing was heard of it from abroad, as appeared from the Philofophical Tranfactions, vol. i. part 1. p. 3. compared with n° 4. p. 78. n° 8. p. 143. n° 12. p. 209. and n° 15. p. 246.

It was thought very defirable, that Signor CASSINI would communicate to the curious a table of this motion for a whole year, which might ferve for obfervations in feveral diftant places in the world. As alfo, that he would fignify of what length the telefcope was, which he employed in thefe obfervations.

There was read part of Dr. CROUNE's Latin paper, *De Formatione Pulli in Ovo*, agreeable to that of Signor MALPIGHI, lately fent to the Society, importing chiefly, that the rudiments of a chick are actually exiftent in the fæcundated egg, even before incubation.

The whole paper was as follows [i]:

" Cum aliquando de ortu animalium aliud, ut fit, ex alio cogitarem, venit in " mentem experiri ea, quæ Cl. Harveus hac fuper re fcripto immortali in lucem " edidiffet. Non vero, ac fi quæ vir ifte prope divinus fcripferat, aut recta non " effe, aut non fatis accurate expenfa vel minimum fufpicarer, fed ut ipfa dun- " taxat eorum, quæ tradiderat, αὐτοψίᾳ animum oblectarem. Quoniam autem " mihi per id tempus in rus quoddam fuburbanum fæpe commigrandum fuit; " ufus fum loci opportunitate, ad hanc rem maxime idonea; erat namque in vicinia " paupercula quædam, quæ magnum gallinarum numerum ad quæftum, five

[g] Letter-book, vol. v. p. 187. It is printed in the Philofophical Tranfactions, vol. vii. n° 82. p. 4032, for April, 1672.

[h] It is printed ibid. p. 4039.

[i] Regifter, vol. iv. p. 157.

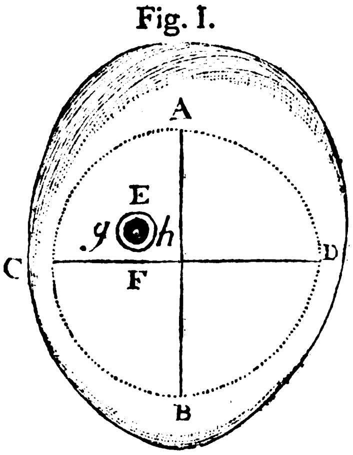
" ex

" ex ovis, ſive ex pullis faciendum, alebat: illa mihi ova omnis generis, tam " recens excluſa, quam ad dies quot volueram incubata, levi pretio obtulit. " Quæ dum inſpicio, ſummamque naturæ ſapientiam, in exigua iſta ovi mole " omnium animantium primordia collocantem, admiror, nata eſt mihi obſerva- " tio quædam maximi, ut poſt videbimus, in hoc negotio momenti, quæ non " ſolum diligentiſſimum naturæ indagatorem Harveum, ſed et alios, quos hac- " tenus viderim, omnes penitus effugit. Ex qua profecto conſtabit, eam eſſe " naturæ in divino hoc opere ſubtilitatem, ut ſerio nobis putandum ſit, unum " hoc omnium eſſe, cujus perfectam cognitionem aut nuſquam certe aut tar- " diſſime conſequamur. Obſervationem autem ipſam, quemadmodum a me facta " eſt, bona fide ſic enarrare aggredior.

Observatio I.

" Mulier itaque iſta, quam dixi, cum forte ex importuno gallinæ ſtrepitu eam " ovum jam tum enixam eſſe comperiſſet, illud continuo ad me attulit; quippe " paulo ante monueram, velle me ovum inſpicere, cui gallina nondum incubuiſſet. " Accepto ovo, alteram quidem corticis partem ſecundum longiorem diametrum " abſtuli [k], quo, liberius effuſo fere omni albumine, vitellum & in eo cicatriculam " contemplari poſſem. Erat quidem hujuſce cicatriculæ diam. $\frac{1}{8}$ fere totius " tranſverſæ ovæ diametri. Quod ideo annotare viſum eſt, quia magnitudo ejus " non tam ab ipſa ovi magnitudine, quam a viribus ejuſdem ac vegeto intus " calore provenire videtur: Namque memini, videre me in ovo anſerino (quod " tamen alijs de cauſis infæcundum fuiſſe conjiciebam) cicatriculam multo mino- " rem quam quæ in omni ovo gallinaceo fere cernitur: imo hoc etiam vel ex eo " patet, quod quo longiori incubatu ovum fovetur, eo latior fit hæc macula atque " amplior. Circulus præterea cicatriculæ hujus, ſive limbus exterior albicans " E *g* F *h* in fig. I. ſumme aquabilis erat, exquiſiteque " ut ita dicam, tornatus: id quod etiam argumento " eſt, ovum hoc robuſtum fuiſſe, naturæque in eo " opus rite hucuſque et alacriter proceſſiſſe. Sequenti " etenim die aliud recentiſſime quoque excluſum " aperui, in quo cicatricula ejuſdem profecto dia- " metri erat; limbus autem iſte exterior laciniofus " omnino ac male concinnatus. Quinetiam et illa, " quæ in centro hujus circuli veluti nebula quædam " obſcure albeſcens ſemper viſitur, in ovo illo priori " ſuperficiei ambitum æqualiter undique termina- " tum, in hoc autem aſperum et interruptum obti- " nuit. Hæc quidem omnia in anteceſſum obſervaſſe " multum ex uſu erit; ut ſtatim vel ex ipſo Harveo " liquebit. Ad ovum itaque illud primum ut " redeam; cum cicatriculam hanc aliquandiu conſpexiſſem, imo et microſcopium " affabre elaboratum (quod tum forte ad manum erat) ad partes vocaſſem, ne

Fig. I.



k Vid. Fig. I.

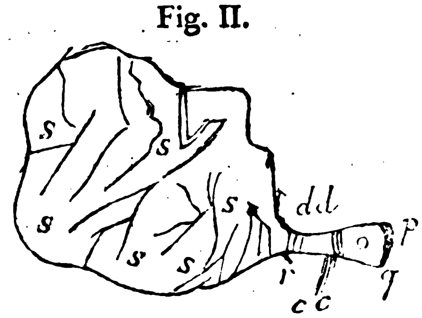
" hilum

" hilum tamen proficere me ſenſi, nec quicquam ipſius ope oculis oblatum eſſe, quod " abſque illo, licet forma minori, diſcernere nequibam. Equidem, ut verum fatear, " nimium vellem aliquid vidiſſe, quod conceptam jampridem apud me ſententiam " de inſtantanea animalium per metamorphoſin (ut loquuntur) productione con-" firmare poſſet. Legeram ante biennium quæ in hanc rem attulerat vir doctiſs. " Antonius Everhardi: Ac, ut nihil diſſimulem, ex iis, quæ ipſe ex Harveo, " p. 75. adduxit, primo mihi anſa ſuſpicandi data eſt, aliquando aliquid in ovo " repertum iri, quod hujus ſententiæ claram omnibus fidem faceret. Verun-" tamen, ut initio dixi, tam parum mihi ſpei reſtabat (quod olim repetitis " ſæpe plurimis experimentis fruſtra fuiſſem) ut cum primum ad ovum hoc " inſpiciendum acceſſi, nihil minus quam hac de re cogitarem. Ut pergam " vero; cum neſcio quid aliud acturo, ovum e manibus deponere neceſſum " eſſet, illud non longe a foco collocavi, utique ut blandum duntaxat calorem " inde acciperet; verebar enim, ne tempeſtas paulo inclementior (erat enim circa " initium Martij hujus anni) efficeret, quo minus pulſationem ſeu motum aliquem " in cicatricula tam pulchra animadvertere potuerim: cum ecce paulo poſt re-" diens, video eam vitelli partem detumuiſſe, quæ cicatriculæ erat propinqua, " foveamque adeo in ipſo factam, quæ piſi majoris hemiſphærium recipere poſſet. " Ipſa quoque cicatricula penitus offuſcata erat; foveæ vero hujus margo, " aliæque circum partes ipſi vicinæ, jam ad latitudinem fere ſemiunciæ undique " indureſcere cœperant; quas quidem omnes facile a reliquo vitello forfice " ſejunxi; ipſum autem vitellum cum albumine paulo ante effuſo famulæ ad " uſus domeſticos ſervandum tradidi. Doluit vero, tam prope foco ovum " admoviſſe, et pulchellam hanc cicatriculam ita temere corrupiſſe. Forte " tum accidit, ut vaſculum aliquod aquæ tepidæ non procul eſſet; dumque " hæc animo verſantur, particulam illam quam dixi vitelli calore ignis incruſ-" tatam et a forfice adhuc pedentem, neſcio quo modo in id conjicio: ubi " dum ſubinde agito, abſceſſit a lutei parte dura cuticula tenuiſſimæ nebulæ " inſtar, eaque: ſubſidente luteo, natabat; hanc dum ſe in aqua varie explicantem " atque evolventem proprius intueor, animadverti primo ipſam fibrillis fere " innumeris, venularum in modum, undique ſcatere, ſacculumque prorſus re-" ferre: poſt autem craſſiculum neſcio quid ſubtus latere videbatur, ac mem-" branulam hanc valde tenuem et ſubtilem pondere ſuo deorſum ferre. Adhæ-" rebat quidem alteri ejus extremitati, quam propterea forfice leniter ſuſtuli, " ut quid tandem eſſet explorarem. Interea rem curioſius ſpectans viſus ſum " mihi videre aliquid capiti fœtus pullive perſimile; quod certe non difficulter " agnovi, quia anno ſuperiori in ovis jam triduum vel quatriduum incubatis " fœtus hujuſmodi, ſed paulo provectiores, ſæpius vidiſſem: quorum unus aut " alter in ampulla vitrea ſpiritus vini plena jam tum apud me erant: hinc avidis " oculis totum quicquid eſt perluſtro, ac clare admodum diſtincteque bullulas " iſtas duas grandiores, quæ oculi quidem ſunt, cum roſtro interjacente, con-" ſpexi; coſtulas præterea coloris lactei, et prominula pedum rudimenta. Exta-" bant etiam velut e ventre bina quidem filamenta non valde exilia, in extremis " laciniata, ac ſi alicunde abrupta fuiſſent; hæc autem vaſa umbilicalia eſſe ex " ſequente obſervatione conſtabit. Quæ cum ipſe paululum ſeorſim conſideraſ-" ſem, aſtantibus quoque monſtravi, e quibus erant nonnulli, qui fœtus, quos

" comme-

“ commemini, priores vidissent. Cæterum membranam hanc delicatissimam cum “ appenso ipsi fœtu, ea qua cernebatur magnitudine, rudi hac figura utcunque ex- “ pressi; quod nisi statim fecissem, perisset mihi bona pars observationis hujus: nam “ cum ipsam in ☿ (ubi etiamnum adservo) indidissem, ut in eo per otium diutius “ et magis particulatim singula contemplarer, dictu citius et pellicula ista ac simul “ fœtus crassescere et albescere cœperunt, speciemque ovi albuminis, diutius in “ aqua cocti, præ se ferre; unde omnia momento mutata minus distincte explica- “ cateque, apparuere. Fig. hæc est S S S mem- “ branulam exhibent; *o p* duas bullulas, *q* ros- “ trum, *d d* costulas lacteas, *r* pedis rudimen- “ tum; *c c* vasa umbilicalia. Monendum est “ autem, ut observatio hæc rite fiat, et ex “ voto succedat, ovum requiri robustum ac “ valido calore intus præditum, cujusque cica- “ tricula latior, & circuli æquabiliter circi- “ nati sint; aliter enim (nisi summe etiam ca- “ veas dum res administratur) tenellula pulli “ corporatura facile diffluit et cum vitello “ permiscetur. Equidem haud potui mihi ipsi non gratulari, quod forte primus “ pullum in ovo, non dico, antequam punctum illud saliens HARVEI appareat, “ sed etiam priusquam ei gallina omnino incubuisset (aut saltem minima temporis “ morula) viderim. Profecto HARVEUS ovum primi circiter quatridui incubatu “ ad fœtum ait præparari; istum vero fœtum jam ante in ovo sub cicatricula “ (ut post patebit) latentem extitisse, hoc ipsi minime perspectum fuit.

Fig. II.



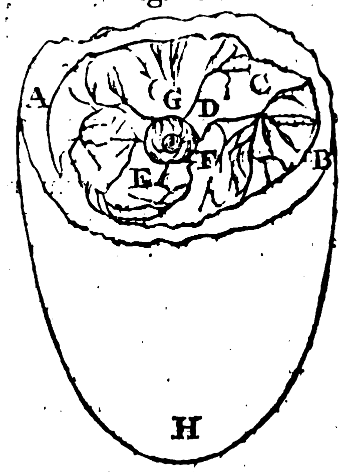
OBSERVATIO II.

“ Ac de prima hac observatione nostra, præcipua quidem ea, &, si ita loqui “ liceat, fundamentali, tantum est: ad secundam venio, quam idcirco attexere “ volui, ut nonnulla paulo explicatius enarrem. In qua profecto mutationes “ istæ, quas commemorat HARVEUS, contingere jam incipiunt; namque in prior “ illa (quod sane prænarrasse opportuit) nihil quicquam aut in albumine aut “ vitello mutatum reperi. De his tamen profiteor hic me nihil (nisi ὡς ἐν παρόδῳ) “ dicturum, utpote quæ (ut superius de ipsa pulli corporatura dixi) non definitis “ admensisque temporibus, sed, pro ovi indole ac vigore, maturius vel serius “ eveniunt. Vicinam itaque nostram rursus adij, jussique ovum, si quod forte jam “ modo editum habuisset, gallinæ supponere. Annuit, ac postquam ad horas “ plus minus 48. sub gallina tepuisset, ad me perlatum est: effracto cortice “ circa angulum ejus obtusum disrupi membranam illam duriorem, earumque, “ quæ totum ovum involvunt, primam; deindeque secundam (quam inter & “ priorem aer inclusus continetur) detraxi, unde exilis hæc corporatura cum toto “ suorum vasorum apparatu optime in conspectum venit. Nisi vero membranam “ hanc amoveris (quamvis ita perluceat, ut & vasa sanguinea & ipsum punctum

 “ saliens

“ saliens utcunque per eam cerni queant) ita tamen etiam in rugas plicasque ob
“ nimiam laxitatem contrahitur, ut ea non ablata nihil satis clare ac minutim
“ videas: & hinc forte accidit, quod ista, quæ jam allaturi sumus, aliis in hoc
“ tempore non comparuerint. Hæc autem membrana earum secunda est, quas
“ in embryotomia comparata enumeravit eruditiss. ac clar. vir. mihique amiciss.
“ D. D. NEEDHAM. Esto in fig. apposita A B albu-

Fig. III.



“ men turbidius ac flavescens, veluti liquamen quod-
“ dam ex ipsius cum vitello permissione ortum (et
“ revera tale esse ex ipso postea HARVEO patebit;)
“ in cujus superficie jacet pellicula C (quæ tertia
“ membrana est, quæ totum ovum investit) vasis
“ undique sanguineis (quæ umbilicalium ramifica-
“ tiones sunt) respersa; nisi quod media illius pars
“ (ubi liquor ista HARVEI clarissime refulgens, quo-
“ vis crystallino humore purior, hospitatur) nempe
“ G D E F; omnino hodie ab iis immunis appa-
“ ruit; quod certe mirum non est, cum in ovis
“ octiduo incubatis duo tantum vasa illa umbilicalia
“ majoribus ramis e purissimi liquoris extremo ambi-
“ tu erumpere videantur; totaque ipsius colliquamenti
“ superficies nullum prosus colorem ducat. In hoc
“ liquore visæ sunt duæ parvæ maculæ, & circa illas
“ corporatura quædam albida, crassitiei quidem insignis, & in purissimo illo
“ humore quasi profundius demersa: si attentius spectes, intra istam corporatu-
“ ram rubedo quædam conspicua est, sed quæ alternis motibus interdum se
“ veluti in ipsam condere, iterumque ex eademmet emicare videtur. Interea
“ vasa illa sanguinea non ab hoc puncto rubro, verum ab ipsa colliquamenti
“ margine originem trahere putes: quod quidem post longiorem incubationem
“ luculentius patet, ut modo dixi: siquidem videre licet quasi ex ipso pulli ventre
“ (non certe a puncto saliente, ut clare animadvertere potui,) vasa aliquot san-
“ guinea, sed pauca, & reliquis, quæ in membranam ante dictam sparguntur,
“ majora, e medio colliquamenti versus marginem inflexa, circa illam erumpere,
“ & in ramos innumerabiles dispesci. Posthæc, totum vitellum (quem albumen,
“ sed infra circa H minime eliquatum aut turbidum sequebatur) effudi, reman-
“ sitque solummodo pellicula ante dicta, quam confestim in aquam tepentem
“ indidi, ubi se in marsupij cujusdam speciem explicavit, qua deorsum versa,
“ apparuit illico pulli corpusculum, huic membranæ inclusum, eique
“ per funiculum umbilicalem appensum hac fere forma ut in figura IV.

Fig. IV.

“ Totum quidem albicans ac pellucidum erat, dumque huc & illuc
“ converto, nec minima jam sanguinis gutta restaret, vidi in medio
“ veluti hujusce corpusculi punctum quoddam lucidissimum valde
“ exiguum, quasi gemmulam aliquam varias luminis stricturas evibrantem; quod
“ proculdubio cor erat. Duravit hæc ex systole & diastole facta micatio per
“ quartam circiter horæ partem, postquam totam pelliculam jam a pulli cor-
“ pusculo separassem; & adeo á prima inspectione, uti beneficio microscopij cog-
“ novi, per horas tres: quod certe jure mirari possumus, tantillam vitæ scintil-
“ lulam

" lulam nôn citius extinctam fuisse. Aderant præterea duæ tresve bullæ circa " capitis regionem; macula quoque versus medium corporis crassior atque alba, " quam jecur vel lienem fuisse arbitror; alia vero prope caudam cernebatur, quæ " pedis erat exordium. Denique funiculus umbilicalis satis manifesto comparuit; " cumque totum soli exposuissem, costas admodum albas & dorsi carinam cla- " rissime conspicatus sum: atque hactenus secunda observatio fuit.

Ad Observ. I. & II.

" Cæterum ut ex allatis hactenus observationibus fructum aliquem colligamus, " manifeste hinc liquet, maturius longe pullum in ovo aut formari quidem, aut " ipsius formationem inchoari saltem, quam harum rerum curiosissimus Harveus " Exerc. xiii. aliique ex eo existimarint. Harv. certe clare innuit (quod a me jam " supra est annotatum) *ova nonnulla celerius mutari, ac tertio ab incubatione die fœtus* " *primordia* (hoc est, ut ipse intelligit, sanguinem & punctum saliens) *exhibere,* " *alia vero ad septimum usque diem nullum futuri pulli specimen edere.* Liquet vero " mihi ex factis aliquoties observationibus fidenter asserere, nusquam ulla istius- " modi primordia aut specimina futuri (ut inquit) pulli apparere, quin simul to- " tus pullus jam præsens adsit, & sub dicta sæpius cicatricula delitescat: imo to- " tum (ut ex prima obs. constat) pullum conspexi, antequam ovum ullam pror- " sus mutationem passum esset; nisi quod cicatricula paulo forte amplior ac ma- " gis æquabili circumductu prædita videretur. Quin adjicio insuper, quando- " cumque aliqua ex istis mutationibus, quas ovum ex sententia Harvei ordine " subit, contingit, integram simul pulli corporaturam existere, ac modo prius in- " dicato reperiri posse; & in ovis generosioribus ac spiritu plenis non tantum " ante ipsam gallinæ incubationem, sed forte etiam ante ipsam e corpore ejusdem " exclusionem. Hic vero magnopere advertendum est, me, etsi non dicam cum " Harveo *ovum pro vario ipsius robore tarde aut celeriter in pullum proficere* (quia " magis verisimile arbitror, momento conceptionis totum simul ac semel confici) " fateri tamen, tenellum hoc corpusculum omniaque adeo ipsius membra, pro " ratione virium in ovo, ac repetitis forte galli coitionibus, citius aut segnius " ab incubante gallina ad perfectionem educari. Quod idcirco monui, ne quis " forte me falsi insimulet, quod ipse easdem observationes facturus pullum simi- " liter ante gallinæ incubitum non statim offenderim; namque mihi satis erit " tam fœlici fuisse, ut in tale ovum inciderim, ubi hunc oculis videre, manibus " tractare, aliisque ostendere licuerit. Hortor illos itaque ad experimenta sæpius " facienda, si primum non successerit; nec profecto absque causa: etenim accepi " ab obstetrice expertissima & fide digna, a qua fœtus humanos abortivos ali- " quando petieram, difficillimum esse cum paucarum adhuc hebdomadum sunt, " cavere, ne cum aquis (ut vocant) erumpentibus evanescant; propter summam " nimirum teneritudinem ac mollitiem. Nec certe cuiquam hoc mirum videbi- " tur, cui lectum fuerit illud cl. Kerkringii in accurata fœtuum osteogenia nuper " edita; ubi *totum* (ait) *corpus in embryonibus ex mera membrana videtur constare:* " & paulo supra, *in iis etiamnum, quæ duorum mensium sunt, omnia capitis ossa membra-* " *nea esse.* Accedit huc, quod eadem alias mihi retulit, se quandoque vidisse fœtus,

"qui unguem pollicis vixdum magnitudine æquabant, membris omnibus rite conformatos, cuticula quoque nitenti & polita exornatos: alios autem ſpithamam totam longos, qui ſpeciem quandam gelatinæ potius informis, quam fœtus humani, redderent. Cum hiſce conſentiunt, quæ de ovis ſive de abortibus humanis ſibi quoque contigiſſe narrat HARV. quorum in aliquibus fœtum quidem invenit, in alis vero nullum: veriſimile autem eſt, in omnibus ſane fœtus adfuiſſe, ſed præ ſumma mollitie diſperditos non apparuiſſe. Porro ex hactenus allatis ſtatuendum omnino videtur, nullo adhuc experimento liquere, quo præciſe temporis momento aut pulli conformatio inſtituatur, aut quando primum in ovo conſpici queat: longe autem a veritate aberrare maximum HARVEUM, dum totius hujus formationis hiſtoriam a puncto ſuo ſaliente ceu primitus extructo, vel potius a ſanguinis apparitione orditur; cum aliunde certò conſtet, punctum illud ſaliens micationes ſuas celebrare non poſſe abſque ope cerebri ac nervorum; unde vel hac etiam ratione ſtatui poſſit, cerebrum neceſſario exiſtere, quotieſcunque iſte cordis rythmus conſpicitur, etiamſi obſervationis fides non accederet. Atqui incertum adhuc ab experimentis eſſe quando primum cernatur pullus; cum in ovis generoſioribus id quidem ante qualemcumque gallinæ incubitum contingat, & forte antequam ab ipſa excludatur; in aliis vero, non niſi ab aliquot dierum fotu & incaleſcentia ſatis firmitatis aut magnitudinis indipiſci, ut oculis intuentium pateat. Quod ſi hæc ita ſint (uti ſunt certiſſime) profecto plurima eorum concidant neceſſe eſt, quæ paulo fuſius quidem, ſed non abſque inſigni facundia, ab HARVEO differuntur. Nolo autem ob ſummam clariſſimi viri authoritatem & reverentiam ſingulà particulatim cenſere; verum ea duntaxat, quæ proprius ex obſervatis ad veritatem accedere videntur, exponam. Quantum itaque ex obſervationibus rite factis colligere poſſumus, illa potius ſententia recipienda eſt, quæ pullum uno quaſi ictu integrum conflari, omnibuſque ſuis partibus præditum eſſe, ipſo forte conceptus momento aſſerit. Cl. HARVEUS contrariam quidem opinionem, ex longa obſervationem ſerie deductam, tuetur: quare ut rem ipſam penetius inſpiciamus, neceſſarium erit, ipſius obſervationes aliquas cum iis, quas ſupra adduximus, conferre. Commemorat autem in prima ovi inſpectione vir cl; cicatriculam illam jam toties dictam a ſe primum pro origine pulli habitam: equidem haud inficior, ipſum quid hæc macula eſſet, multo clarius ac diſtinctius explicare, quam quiſquam alius fecerat. PARISANUS tamen (ut ab HARVEO citatur) e macula ipſa pullum oriri agnovit, deque ea fortaſſe rectius quam putarat HARVEUS, ſenſit: facile enim crediderim e verbis iſtis, quæ ex ipſo attulit HARVEUS, eandem fere ipſi quæ mihi obſervationem, obtigiſſe: *priuſquam enim* (inquit PARISANUS) *rubor aliquis in fœtus corpore appareat, duæ extant in eo minimæ bullulæ*; *initio tamen rubore earum nulla prædita eſt.* Et hoc quidem recte, quod tamen pace cl. HARVEI dixerim; qui iſta continuo ſubjicit. Exerc. xvi. *At vero nec bullula aliqua conſpicua eſt antequam rubor ſanguineus appareat, &c.* Ego tamen (ut dixi) non modo bullulas duas (quas quidem male PARISANUS pro corde ac jecore habet, cum oculorum potius rudimenta ſint) verum etiam pullum integrum conſpexi, ut jampridem in obſ. prima dictum eſt. Equidem ex citatis PARISANI verbis haud ægre adducor ut credam, eum, dum hæc inveſtigaret, in hujuſmodi ovum incidiſſe, quod integram pulli cor-

"poraturam

" poraturam in colliquamento demersam ipsi spectandum præberet. Sed cum quid
" esset nesciret, binas solummodo bullulas, utpote reliquis partibus conspectiores,
" observasse, easque ex recepta tum fere apud omnes sententia, pro corde & je-
" core habuisse. Cæterum, ut dixi, credibile est, eodem, quo fit conceptus, mo-
" mento pulli corporaturam formari: quid enim aliud est conceptus vel ipsi HAR-
" VEO, quam papula ista, quæ oviparis ex ovario [1], viviparis ex utero erumpit? At-
" qui autem (ut vivipara in præsens omittam) papula ista ovum est, ovum, inquam,
" integrum; non vitellus tantummodo, ut initio operis dixerat HARVEUS; sed, ut
" alibi rectius, Exerc. xxxvii. *aliquid potius compositum, quod ambos liquores (albumen*
" *scilicet & vitellum) permixtos in se contineat: colore quidem vitellum refert, sed consisten-*
" *tia sua propius ad albumen accedit*, &c. Quid quod alias quoque dicat Exerc. xxvii.
" ovorum hæc primordia ceu papulas *propria anima vivere?* Denique verbis disser-
" tis Exerc. xxviii; *galli & gallinæ fructus, sive conceptus communis, est ovum:* paren-
" tis utriusque virtutem referens. Quidni autem maculam quoque ovo huic inesse
" dicamus? Certe (fatente HARV. Exer. xxix.) ovum fœcundum est sperma et semen
" genitale, plantarum semini analogon; sed enimvero quod in plantarum semine
" est germen, id in ovo sive animalium hoc spermate macula est, sive id potius
" quod sub macula latet, pulli nimium corpusculum. Nec quenquam exterreat
" corpusculi hujus veluti immensa exilitas; namque, si ad calculum geometricum
" res exigatur, facili ostendi posset, dari in rerum universalitate particulas actu
" minores, quam quæ hoc corpusculum constituere debent. Præterea, cum re-
" ipsa constet, ovum nihil esset aliud quam talis materiæ struem atque appara-
" tum, unde corpusculum hoc ali atque augeri queat; cur, obsecro, putemus,
" apparatum hunc adesse, pullum vero alendum neutiquam adesse? Per appara-
" tum hunc, & ipsos liquores alimentares, & vasa ad eos deferendos necessaria,
" & membranas, quæ vasa ista sustentant, intelligo. Namque, ut diximus, te-
" nerrima ista membrana, quæ in tepida natabat, innumeris ubique vasis obsita
" erat; ut minime dubitarem, quin liquor aliquis in iis fuerit, & certe is ipse, qui
" postmodum induta rubedine sanguinis appellationem obtinet. Qualis fere, ex-
" empli gratia, in astacis aliisque testaceis (quorum sanguis semper albicat) videri
" solet. Sed ut eo unde discessi redeam; *postquam ovum horas 24.* (inquit HARV.
" Exerc. xv.) *tepuit, vitellus, qui prius in albuminis centro hærebat, versus cacumen*
" *obtusum assurgit; fitque ut vitellus cavitati per cicatriculam conjungi videatur.*
" Id quod hoc vel consimili pacto evenire arbitror: dum gallina ovum incubat,
" calor ab ipsa proveniens aërem in superiori sive obtuso ovi angulo, ad usum re-
" spirationis (ut deinceps ostendam) relictum, insigniter rarefacit; unde is, quem-
" admodum in Thermoscopio vulgari, liquores subditos premit. Cum autem vi-
" tellus, a chalazis utrinque suspensus, membranæ, albumen immediate obvolven-
" ti, aliquantulum hæreat, fit ut ipsum albumen facilius locum cedat, proinde-
" que deorsim comprimatur, & vitellum in eo libratum versus superiora attollat.
" Interim eadem opera membrana ista secunda simul detruditur, unde vitelli macu-
" la cavitati veluti conjuncta apparet. Sed ad secundam jam inspectionem acceda-
" mus; hic enimvero illud maxime animadverti, quod ipse fateatur Exerc. xvi. *adeo*
" *tenuem esse ipsius colliquamenti membranam, ut, nisi summam curam adhibeas, fa-*

[1] Quod uteri tantum pars est superior & crassior.

" *cile dissiliat*, fontemque confusione liquorum turbet. Idcirco minus mirandum " est, si ipsa etiam fœtus rudimenta, quæ juxta HARVEUM in medio hujus col- " liquamenti sunt, levissimo momento elabantur, nec quæsita hoc tempore omni- " no compareant. Occasione hujus colliquamenti addit HARVEUS, fœtum in " eo natantem, ex utero cervæ exemptum, regi CAROLO I. a se ostensum. Liceat " etiam mihi similiter, hic fœtum humanum (eoque gratius naturæ spectaculum " & insolentius) memorare; viro cl. ac doctiss. D. D. CLARKE majestatis regiæ " medico, visum esse, in ovo suo natantem, membris omnibus exquisite instruc- " tum & consummatum. Quinetiam jam apud me pullus in ☿ adservatur, egre- " gia corporis albedine in colliquamento suo spectabilis, semunciam fere longus; " quem nonita pridem illæsa delicatissima ista membrana ex ovo exemi. Videamus " inspectionem tertiam, ubi optime monet Exerc. xvii; *ea quæ jam visuntur sic plerun- " queevenire, non enim* (inquit) *est hoc perpetuum, cum magna sit in ovorum maturi- " tate diversitas*, &c. Et paulo post, *quædam ova die quinto minus perfecta sint " quam alia tertio*. Considera mihi, obsecro, an non hinc evenerit, ut ipse pul- " lum ante qualemcunque gallinæ incubitum repererim? Istaque præterea cuncta " mihi fuerint oblata, quæ jam supra explicui? Ex quibus profecto consequitur, " nescire nos penitus quo præcise temporis momento pullus formetur in ovo, seu " papula potius: illud certum est, non errasse peritum (ut eum vocat HARVEUS) " dissectorem, VOLCHERUM COITER, qui globulos secundo post incubitum die vi- " dit; quod tamen negat HARVEUS. Prius vero quam ulterius pergam, non- " nulla de ipsa hæc macula sive cicatricula annotare placet. *Primo*, inquit HARV. " Exerc. xv. *inspectionis die dicta macula dilatatur, & in circulos dispertitur, qui pun- " ctum album pro centro habent*: equidem unicolorem vidi, hoc est, totam albam, sed " plerumque spatium quoddam fusci coloris inter albescentem circulum & cen- " trum jam dictum interjacet, qui longiori incubatu amplior fit, imo in plures " circellos quasi diffinditur; ipsumque tandem centrum evanescit; unde arbitror, " maculas hasce omnes principio unicolores esse; sed ope caloris materia illa al- " bida (quæcunque fuerit) e qua constituitur, paulatim in circulos dissilit, tan- " demque in omnem undique partem amota, purum illum cicatriculæ liquorem " detegit atque ostendit. Frustra ergo quæstionem hic agitat HARV. Exerc. xvii. " punctum hoc album, quod maculæ centrum est, in rubrum illud saliens postea " convertatur; nam si quis rem attentius pensitet, existimabit potius, materiam " hanc albidam liquorem crystallinum obtexisse duntaxat, pullumque in ipso, " ad cujus forte, dum mollissimus est, defensionem a natura comparata est. Cæ- " terum de quarta jam inspectione dicamus; in qua nolo tam solicite veritatem " consectari, ut in virum, omnium sæculorum memoria dignum, quemque a lon- " ginquo venerari debeo, quicquam inverecundius admisisse videar. Aio itaque, " ea, quæ ibi tam eleganter curioseque descripsit, procul dubio verissima esse, at- " que sic plane ipsi, dum per illæsum adhuc vitellum transpicere voluit, (ut " fecisse eum non uno e loco hujus exerc. colligere possumus) apparuisse. Nam- " que pulli corpusculum non eundemmet semper in liquore suo situm obtinet, " adeoque non iisdem sui partibus se videndum præbet, ut mihi sæpius experto " constat: nec aliunde provenisse autumo, ut quæ superius a nobis allata sunt " viri perspicacissimi diligentiam effugerint. Cum itaque apud me cogito nuspiam

I " videri

" viderii novo punctum faliens, aut lineam ullam fanguineam, quin tota pulli corpo-
" ratura reperiri queat, mirari fubit ista verba Exerc. xvii: *certo constat, futuri fœtus*
" *nihil omnino hoc die apparere* (tertio fcilicet) *præter sanguineas lineas & punctum sa-*
" *liens*. Fateor equidem fub finem exerc. xviii. dicere illum hæc; *immisso in aquam*
" *limpidam corporis rudimento, quid ejus factum sit, quid etiamnum desideretur, cogni-*
" *tu facile esse:* ita fe omnino res habet, atqui id feciffe fe non meminit; at de-
" mus, feciffe; forte femel vel bis: unde facile evenire potuit, ut in fœtu lacero
" ac læfo, atque ex ovo fortaffe imbecilliori defumpto, omnia non perviderit. Quod
" fi experimentum hoc rite ac caute fuiffet adminiftratum, nequeo divinare quo-
" modo pullum non repererit. Sed quid fi ipfe viderit? imo vidit profecto, nec
" enim aliud fonant verba ifta Exerc. xviii. *In provectioribus ovis aliquando sub finem*
" *quarti diei* (imo ut plurimum, & citius, fi ova fpiritu & vigore abundent) *nescio quid*
" *turbidi vesiculos pulsantes obumbrat, &c.* Preterea *nebulam hanc corporis rudi-*
" *mentum* diferte appellat; fed in eo minus cum veritate confentire videtur, dum
" *ex colliquamenti parte concoqui vult, & circa venarum principia concrescens effluvium*
" vocat. Alibi vero admodum prope ad ipfam acceffit; ubi fatetur dubitare
" fe, *numnam facta colliquamenti coagulatione una cum sanguine & puncto saliente*
" *hoc etiam corporis capitisque rudimentum statim existeret* (uti revera exiftit) fed
" *tenue adeo & pellucidum* (pulchre omnino & veriffime) *ut visum prorsus effugeret,*
" *donec in situm & mucorem crassescens, albedinem induat qua percipiatur: dum in-*
" *terim sanguis crassior ac rutilans in colliquamento tam diaphano facile conspicitur.*
" Hæc etfi paulo longiora exfcribere tamen volui, quia ratio hinc optima peti
" poffit, cur non difficulter pulli corpufculum adeffe concedamus, etfi quandoque
" fortaffis inveniri nequeat. Etenim præcipue animadvertendum eft, alias fœtus
" partes præ aliis magis confpicuas effe; imo eas magnitudine & crefcendi veloci-
" tate cæteras antevertere, quæ ufu præftatiores funt, ac magis neceffariæ; quales
" funt cerebrum inprimis, quod proportione reliquas omnes excedit fuperatque;
" fpina etiam feu carina dorfi; quippe ab his, omnem fenfionem profluere mox
" oftendam, quicquid contra de cordis five puncti falientis irritatione dicat HAR-
" VEUS Exerc. xvii. tum autem cor ipfum, quod intra nebulofum hoc corporis
" concrementum (ut ex obf. noftra fecunda conftat) fyftolas & diaftolas fuas vi-
" brans purpurei liquoris beneficio cernitur. Reliquis infpectionibus non immo-
" rabor, in quibus omnia adeo clara & perfpicua jam funt, tamque accurate ab
" HARVEO copiofeque enarrantur, ut nulla fuper his contraverfia exoriri queat.
" Cæterum hoc loco opportunum erit, ea quæ contra fententiam HARVEI difpu-
" tavit vir cl. ANTONIUS EVERHARDI paulifper defpicere: quæ & obfervationes
" quidem noftras egregie confirmant. Enimvero vir ifte eruditifs. eandem nobif-
" cum fententiam de inftantanea animalium (ceu in proplafmate quodam) forma-
" tione complectitur; eamque ex [m] modo recenfitis HARVEI verbis eruere velle vi-
" detur: argumento (inquit) *certissimo, corporis rudimentum, etiamsi præ exiguitate vi-*
" *sum fugiat, una cum cordis corpusculo delineari.* Poftquam autem hiftoriam fuam
" de animalium ortu ab experimentis cuniculorum exftructam, abfolviffet, hæc
" habet: p. 73. *sed mirabitur fortasse quispiam, quod in primis meis observationibus*
" *puncti sanguinei salientis & mentionem non fecerim; sed mox initio meminerim embryonis*

[m] Pag. 22. lin. 5. Ant. Ever. de Ort. An. p. 54. 76.

" *jam*

"*jam conspicui rudimenti, &c.* & paulo post; *fateor* (inquit) *punctum saliens fibrasque sanguineas in ovo primum quidem apparerere* (in quem proculdubio errorem non incidisset, si, ut in cuniculis, de quibus summas ipsi gratias agimus, pariter in ovis experimenta fecisset;) *sed an eadem res ita se habeat in generatione viviparorum, valde dubito, aut vix credo.* Equidem vir cl. uti tu nos hac in parte sublevasti, ita nos tibi (uti speramus) facem aliquam in oviparis accendimus; ut adeo ex iis, quæ jam es dicturus, summa ista cognatio, ab ipso HARVEO toties agnita, quæ viviparorum generationi cum oviparis intercedit, clarius percipiatur: namque sic pergis p. 74.; *In productione cuniculorum punctum sanguineum saliens, fibræque sanguineæ, post jactum futuri fœtus rude fundamentum mihi semper apparuere; & hoc non modo in generatione cuniculi, sed ipsius etiam hominis observavi.* Ac pluscula in utroque genere exempla profert, quæ apud ipsum autorem inveneris. Profecto punctum hoc saliens rubrum primis quibusque incubationis diebus potissimum cernitur in ovo: insequentibus autem e conspectu abire, *neque amplius extra moveri, sed obtegi ac cooperire videtur*; ut optime (apud HARVEUM; Exer. xvii.) *Ulysses Aldrovandus annotavit: duo autem (ait) isti meatus venosi evidentiores conspiciebantur, alter vero major altero.* Quisque hoc facile experiri poterit; quocirca paulo durior in cl. virum hoc in loco est HARVEUS, dum falli ipsum asserit. Ut summatim dicam, haudquaquam dubito quin maximus noster HARVEUS fomationis partium pulli historiam verissime quidem accuratissimeque adornarit; licet non eo quo extiterunt ordine (omnes enim initio simul co-existunt,) sed eo quo ipsi apparuerunt. Video autem, duo mihi hic monenda esse; nuspiam fere eodem aut consimili ritu pulli exordium in colliquamento cerni, sed pro varia ejusdem in illo situ variaque ovi indole, nunc hoc nunc alio modo, sub obtutum cadere. Deinde ex ipso HARV. aliud Exer. xx. (etsi jam supra idem dixerim;) *ova quædam præcocia & provectiora esse, omniaque explicata magis habentia; alia tardiora, membrisque (quod summe notandum est) minus distincta apparere. Quanquam alias non parum ad hanc rem faciant anni tempus, locus, externa fomenta, diligens incubatio,* &c. Hæc autem ideo monere necessum erat, ne quis forte, dum observationum nostrarum experimenta capere aggreditur, eaque quæ dixi non continuo offendat, eas aut sublestæ fidei, aut saltem hallucinatum me, esse arbitretur. Quoniam autem ex dictis evidenter liquet, longe aliter se habere formationem pulli in ovo, quam ab HARVEO existimatum est; consequitur profecto, eorum magnam partem, quæ ex historia a se descripta deduxit, erroris haud immunem esse: uti sunt ea, quæ exerc. li. de generationis ordine habet ac particula genitali prima; quaque exerc. lii. de dignitate ac præstantia sanguinis, ejusque primo ortu; de sensione puncti salientis; nonnulla etiam, quæ de ovo tradidit, quod a sola gallina absque ullo uspiam galli initu concipi posse sæpius asserit; alias vero diserte sibi adversatur exerc. xxviii. quicquid autem garriant aniculæ, hoc omni vere experientiæ repugnare certum est. Quin etiam de pulli in ovo nutritione, ob incognitum adhuc NEEDHAMI ac STENONIS ductum intestinalem, ac adeo de ejusdem respiratione (cujus obs. pulcherrimam nactus sum,) dum intra ovum concluditur; sed de his aliisque, quæ huc attinent, uti de sede libidinis in gallinis, earumque fœcunditate a galli coitionibus magis minusve aucta, ubi plus otii erit, disceptabo."

April

April 4. Mr. HOOKE made an experiment with two pieces of glafs ftiffly rubbed upon one another, to fhew that there may be the fame incidence of rays, and yet various colours. And he was ordered to bring an account of this experiment in writing at the next meeting, together with his confiderations upon it; as alfo to draw up and give in an account of the experiment, made at the laft meeting, with fal-nitre diffolved in common water.

Mr. OLDENBURG produced a printed fheet in folio, dedicated to the Royal Society by Dr. JOHN SWAMMERDAM, a phyfician in Holland, concerning the ftructure of the *uterus* and *ovarium* belonging thereto, &c. It was recommended to the confideration of Dr. SMITH and Dr. BROWN, who were defired to make a report to the Society at their next meeting, of what might be peculiar in it.

Mr. OLDENBURG communicated a letter to him from Mr. NEWTON, dated at Cambridge 30th March, 1672 [n], containing his anfwer to the difficulties objected by Monf. AUZOUT againft his reflecting telefcope: as alfo the queries of Monf. DENYS concerning it; together with Mr. NEWTON's propofal of a way of ufing, inftead of the little oval metal in that telefcope, a cryftal figured like a triangular prifm.

Mr. HOOKE was ordered to make fuch a cryftalline prifm for the defign mentioned in Mr. NEWTON's letter, and to try the fame.

There was read a paper of Dr. GREW, fent to Mr. OLDENBURG from Coventry, 12 March, 167$\frac{1}{2}$, containing fome obfervations about fnow; which was applauded as an ingenious difcourfe, and ordered to be regiftred [o].

Mr. HOOKE promifed to bring in fome other experiments of colours at the next meeting.

The reading of Dr. CROUNE's Latin difcourfe, *De Formatione Pulli in Ovo*, was ordered to be continued when himfelf fhould be prefent.

April 10. At a meeting of the COUNCIL were prefent,

Sir ROBERT MORAY vice-prefident,
The lord vifcount STAFFORD,
The lord HENRY HOWARD of Norfolk,
The lord bifhop of Chefter,
Sir THEODORE des Vaux,
Dr. GODDARD,
Mr. COLWALL,
Dr. WALTER NEEDHAM,
Mr. CREED,
Mr. OLDENBURG.

[n] Letter-book, vol. v. p. 193. An extract of it is printed in the Philof. Tranfact. vol. vii. n° 82. p. 4034.

[o] Regifter, vol. iv. p. 92. It is printed in the Philofoph. Tranfact. vol. vii. n° 92. p. 5193, for March, 1673.

There was made a propofal from Mr. EVELYN by Mr. OLDENBURG, for letting out Chelfea college to be a prifon-houfe during the war [p]; together with an intimation, that Mr. EVELYN hoped to procure a rent of one hundred pounds a year for it, befides fome neceffary repairs of the houfe. Hereupon it was ordered,

That the prefident, the treafurer, and the fecretary, who officiates, fhould have power to agree, in the name of the council, with Mr. EVELYN, about the matter propofed, and conclude with him and his collegues, if the above-mentioned hundred pounds *per annum*, together with good repairs, could be obtained; and that upon the agreement concluded, they make a report to the council, in order to its paffing under the feal of the Society: and that Mr. EVELYN be thanked for his care of the concerns of the Society:

It was propos'd by the lord HOWARD, that care might be taken to let out the the five acres of land lying about Chelfea-college, to fome perfon or other, who would hedge it about, for any rent.

Sir ROBERT MORAY hereupon propofed, that he would fpeak with captain THORNHILL about letting that land.

It being mentioned by Mr. HOOKE, who was called into the council, that Sir JOSEPH SHELDON had fpoken to him of fifty acres of land, which he believed to belong to Chelfea-college; it was ordered, that the prefident fhould be defired by the council to take notice of this information, and to confer with Sir JOSEPH SHELDON about it.

The bifhop of Chefter propofed Dr. GREW to be a curator to the Society for the anatomy plants for a year, upon fubfcriptions, amounting to fifty pounds, to be made by fuch members as fhould be willing to contribute thereto.

The council approved of this propofal, and ordered, that it fhould be fignified to the body of the Society at their next meeting, in order to actual fubfcriptions.

It was moved by the vice-prefident, that whereas Thurfday proved inconvenient to divers confiderable members of the Society to meet, that day might be changed again, and Wednefday appointed for the weekly meeting-day, as it had been formerly.

The council approved of this change, and ordered, that it be fignified to the Society at their public meeting, on the Thurfday following.

It was ordered, that the treafurer pay one year's falary to Mr. HOOKE.

[p] With the States-General.

April

April 11. The Society did not meet.

April 18. Mr. HOOKE was ready to make an experiment by a prifm, viz. to deftroy all colours by one prifm, which had appeared before through another: but there being no fun, as was neceffary, the experiment was deferred.

Several letters to Mr. OLDENBURG, concerning matters relating to the Society, were read.

1. From father PARDIES the jefuit, profeffor of mathematics in the college of Clermont in Paris, dated there April 9, 1672, N. S[q]. containing fome objections againft Mr. NEWTON's theory of light and colours.

2. A letter from Mr. NEWTON, dated at Cambridge April 13, 1672[r], containing an anfwer to the objections of the faid jefuit.

3. Another letter from Mr. NEWTON of the fame date[s], anfwering fome experiments propofed by Sir Robert MORAY for the clearing of his theory of light and colours.

4. From Signor MALPIGHI, dated at Bologna April 5, 1672, N. S.[t], expreffing his readinefs to comply with the Society's defire, that he would continue his diligence in the anatomy of plants, and his obfervations on the formation of a chick in the egg.

Mr. COCK having produced a concave of fteel for a reflecting telefcope, which, he faid, he was not able to make all over of the fame hue, it being in its greateft part darker than in the reft about the edges; he was ordered to polifh it as it was.

Mr. HOOKE propofed a way of making thefe reflecting concaves in great numbers, and polifhed by the means of two dyes, one concave, the other convex, putting between them a plate of filver, and then ftamping them with the mint-mill.

It was doubted by Mr. ROBERT MORAY, whether it would be polifhed this way, and keep its figure. However, it was thought worth trying; and therefore it was ordered, that Mr. SLINGESBY fhould be defired from the Society to fee this experiment tried for them.

There were read fome obfervations concerning the voyage lately made to Eaft Hudfon's Bay, and the ftate of that country and its inhabitants, communicated

[q] Letter-book, vol. v. p. 204. It is printed in the Philofoph. Tranfact. vol. vii. n° 84. p. 4087.

[r] Letter-book, vol. v. p. 218. It is printed in the Philofoph. Tranfact. ubi fupra p. 4091.

[s] Letter-book, p. 222. It is printed in the Philofoph. Tranfact. n° 83. p. 4059.

[t] Letter-book, vol. v. p. 202.

to Mr. OLDENBURG upon his inquiries, by captain GUILLIAUME and Mr. BAILEY, two of the chief perſons employed in that voyage, who had wintered there. Theſe queries and anſwers were ordered to be regiſtered [u], and were as follow:

" 1. What time of the year they ſet out from hence, and when they arrived " at the place intended? Reſ. They ſet out June 5. and landed Auguſt 22. in " the bottom of Eaſt Hudſon's Bay, being fifty degrees and forty-five minutes " north latitude, and diſtinct from the weſt bay, the place of captain JAMES's " wintering, which was in fifty-two degrees and thirty minutes latitude.

" 2. In what degree of latitude they met with the firſt ice, and at what time of " the year? Reſ. In fifty-nine degrees; in the beginning of Auguſt, they met " with icy iſlands moving.

" 3. How far north they ſailed? Reſ. Firſt, to the entry of the ſtraits, that " let them into Hudſon's Bay, which entry is at ſix and an half degrees north " latitude, whence they run up higher to the latitude of ſixty-three degrees (the " moſt northward place they went to) and thence they run down again near three " hundred leagues due ſouth, to about the latitude of fifty-one degrees, and lon- " gitude about three hundred and ſeven degrees.

" 4. In what month the moſt northern parts, which they muſt make, are moſt " convenient to paſs? Reſ. In Auguſt and September; and they hope they " ſhall be able hereafter to go and come in one and the ſame ſummer, by ordering " their voyage ſo, as to be there about the middle of Auguſt, and by coming away " about the beginning of September, the commodities of the place lying, upon " agreement with the natives, ready to be ſhipped immediately upon their arrival.

" 5. What depth of water they had where their ſhip anchored, and they win- " tered? Reſ. About nine or ten foot, but in the ſtrait's mouth, it is ſo deep, " that they found no ground at three hundred fathoms; and all along within " thoſe ſtraits deep enough, though many iſlands every where.

" 6. What they obſerved as to the variation of the needle? Reſ. At fifty- " three degrees they reckoned no variation; about fifty-four degrees they reckoned " about one degree of variation, weſtward; and thence the variation increaſed " very conſiderably, ſo that, at the entry of the ſtraits in ſixty-one degrees and " an half of latitude at Cape Worſenam, the needle varied thirty-two degrees " weſtward, and at ſixty-three degrees at Digges's iſland, it varied about thirty-ſix " degrees; but running down to the ſouth for about three hundred leagues, to " the latitude of fifty degrees and forty-five minutes it varied twenty-ſix degrees. " Captain JAMES reckoned twenty-nine degrees variation where he wintered.

" 7. What obſervable about the tides? Reſ. In thoſe ſtraits there runs a con- " ſtant tide, eaſt ſouth eaſt, and weſt ſouth-weſt, but in the bay it runs north

[u] Regiſter, vol. iv, p. 190.

" and

" and fouth; entering into the ftraits a fouth-eaft and fouth moon maketh a full " fea; but further within the ftraits a fouth moon doth it; and where they " wintered a fouth fouth-weft moon maketh a full fea. The tides commonly " rife not above eight foot perpendicular hight, though they are much governed " by the winds, which are very variable there, and being high from the north- " weft, raife the tides to the hight of twelve foot in Rupert's River.

" 8. Whether the thick foggy air did make their compafs move fo dully, that " it would not traverfe? Ref. This, they apprehend, would come to pafs, but " they prevented it by ufing Mufcovy-glafs.

" 9. What kind of people the natives are where the wintered? Ref. They " are tawny, living in tents, which they remove from place to place, according " to the feafons of hunting, fowling, and fifhing. Their arms are bows and ar- " rows; their meat is venifon, wild fowl, (as geefe, partridge) and rabbits, all " which are as white as fnow, and in great abundance; the captain affirming, " that he had killed feven hundred fuch white partridges. They have alfo ftore " of fifh, as fturgeon, large pikes, falmon-trouts, taken by them with nets; " great fifh they had feen none, but fome fea-horfes and feales, going into the " bay; no cod nor whales. As to their drink, they ufe much the broth of their " boiled venifon, no crude water. Concerning their phyfic, they ufe chiefly " fweating, not by taking any thing inwardly, but by making a kind of ftove, " heating many ftones red hot, in their tents, and then pouring water upon them, " whereby they are made to fweat exceffively, in which condition, when they " have fat a while, they run out into the fnow, whereby they fay their pores " are prefently clofed again, as they were opened by the heat, laughing at the " Europeans, that caufe themfelves to be rubbed and dried with cloths. They " live many of them to a great age, to an hundred and twenty years. From the " fouth-weft of Carleton ifland, about fifty degrees latitude, there came many In- " dians to them, that were fix foot nine inches tall, living among the frefhes, " and much upon fifh, on the river Moufibi, that is the river of elks, fo called " from the ftore of elks, that are to be found there.

" The commodities they delight in are coarfe cloth, iron, hatchets, hammers, " kettles, pins, needles, and fuch like, very ready to exchange them for beavers.

" 10. What kind of foil it is, and what it produceth? Ref. It is moft clay " ground, plain, and very moffy, bearing no grain at all, only vetches, goofe- " berries, ftraw-berries, cran-berries. It abounds in wood, efpecially birch, wil- " low, and firr-trees, which laft kind of tree hath an excellent turpentine (as " they call it) on its bud, which boiled in their beer they found very wholefome, " and reftoring them to ftrength and vigor when they looked pale, and were fick " and weak.

" 11. What animals the country affords? Ref. Store of deer, hares, elks, " and beaver, all which are very good meat: for other beafts, there are white

" foxes,

" foxes, white bears, white cats, all yielding excellent furr, which is exceeding " thick.

" 12. What obfervable chiefly about beavers? Ref. They faid, they had not " been up fo far into the frefhes, (for upon them they only live) as to fee them- " felves their manner of living and breeding; but they had been told by the " Indians, that they build their lodges two ftories high, cutting pieces of wood " from the neighbouring trees, of that length and bignefs, as is requifite for their " purpofe, and then meeting a competent number of them together, whereof the " one half place themfelves on one fide of the piece to be fhoved away, and thurft " their tails under the wood to the other fide, where the other half ftanding ready, " do faften their teeth into the tails of the other, and fo fhove away the wood " to the place defigned to build in, where they raife two ftories, to the end, " that when the water fwells, they may go up to the other ftory, in which they " alfo breed their young ones. Beavers live not upon fifh, but rinds of trees.

" 13. How the captain of our fhip and his company ordered themfelves as to " their manner of living, whilft their ftaying there? Ref. When they came on " fhore, they built themfelves a houfe of wood, and dug a cave fome eight or " ten foot deep, into which they put fome barrels of good beer, which at the " time of their coming away being taken up again, after it had remained there " eight or nine months, proved very excellent liquor. Mean time they brewed " all the winter long, of the provifion of malt they had taken with them; " and for their meat they went a hunting, and with their guns killed ftore of " deer and fowl.

" 14. What temper they found that country of in the months of May and June? " Ref. The fpring began in May, in June they found it pretty hot in the day- " time, and ftore of mufkittos, but froft in the night.

" 15. How they had their health there? Ref. Reafonably well; only in re- " turning they found fome trouble of the fcurvy, and that chiefly in their mouths.

" 16. What government and religion they have amongft themfelves? Ref. " They have fome chief perfons that are above the reft, yet working with them; " they found no quarrelling amongft them; they love keeping one's word; are " very fenfible of love and kindnefs; and they exprefs their hearty forgivenefs, " by a gefture of throwing the arms behind their back, which when they do, " you may rely upon them as perfectly reconciled. They acknowledge fome fu- " preme power, which they call Maneto, and they have a Pawaw, by whom " they addrefs themfelves to their God, and acquaint him with their neceffities, " which Pawaw returns them anfwer of help and relief, and that commonly " upon conditions of giving fuch and fuch commodities, among which tobacco " is one of the chief."

The

The Society was made acquainted with the two particulars lately passed in the council April 10, 1672: the one, that the day of the Society's weekly meetings was henceforth to be on Wednesday again, as it had been formerly; because Thursday proved inconvenient to divers considerable members of it, who were assiduous at their meetings. Upon which it was ordered, that tickets should be sent to the members about London, who were not present at this meeting, to give them notice of this change. The other was, that the bishop of Chester had proposed Dr. Grew to be a curator to the Society for the anatomy of plants for a year, upon subscriptions amounting to fifty pounds, to be made by such members as should be willing to contribute for the raising of that sum; and that the council had approved of that proposal, a form also being drawn up, and now ready for the subscriptions of such, as would freely contribute to so good a work.

It was ordered, that the thanks of the Society be returned to the lord bishop of Chester for this proposal, and to the council for their approbation of it: as also, that his lordship be desired to take care of the subscriptions.

Mr. Hooke promised some experiments about colours at the next meeting.

April 24. Signor John Dominic Cassini and Francis Vernon, Esq; were proposed candidates by Mr. Oldenburg, they both having intimated their designs of being elected into the Society, in their letters from Paris of April 23, 1672, N. S. [x]

Mr. Hooke shewed two experiments of colours with a couple of prisms. By the one it appeared, that one prism took off the colours, which the other had produced: by the other, that several colours were made by several refractions. He was ordered to give in the particular description of these experiments to be registred.

Signor Cassini's letter to Mr. Oldenburg of 23d April, 1672, N. S. presenting the Society with the printed description of his late observations concerning the periodical motion of a great permanent spot in Jupiter, and the phænomena of the late comet, was read.

Mr. Oldenburg read also the letter of thanks [y], ordered by the last meeting to be returned to Signor Malpighi, which was approved of, and ordered to be sent away.

There was likewise read a Latin letter to Mr. Oldenburg, from Dr. Thomas Cornelio, dated at Naples 5th March, $167\frac{1}{2}$, N. S. [z] expressing his great respect for the Society, and its institution; accompanied with a letter of his in

[x] Signor Cassini's letter is inserted in the Letter-book, vol. v. p. 229, and Mr. Vernon's, p. 228.

[y] It is dated April 24, 1672, and is entered in the Letter-book, p. 231.

[z] Ibid. p. 179.

Italian

Italian, to JOHN DODDINGTON, Esq; the king's resident at Venice [a], containing divers particulars relating to the tarantula, and the relations of persons pretending to be stung by them.

May 1. Signor CASSINI and Mr. VERNON were again proposed candidates by Mr. OLDENBURG, upon the desire of both of them expressed in their letters of April 23, 1672. N. S.

Dr. WILLIS presented to the Society his book, intitled, *De Anima Brutorum Exercitationes duæ, prior Physiologica, altera Pathologica,* printed at Oxford, 1672, in 4to.

Mr. BOYLE shewed an experiment, importing, that water will easily pass where air will not. He was desired to give the contrivance of the whole, and his considerations thereupon in writing, to be registred.

Mr. OLDENBURG read a letter from Mr. LISTER to the archbishop of York, dated at York 10th April, 1672 [b], and by his grace communicated to the lord archbishop of Canterbury, who delivered it to Sir ROBERT MORAY, in order to be imparted to the Society. It contained an exact account of the excision of a stone from under the tongue of a man, where it had been breeding about eight years. It had visible impressions upon it of some capillary vessels, amongst which it grew; and it was scabrous and sand like, though the substance was tophaceous.

Dr. KING affirmed, that he had found the like stone come away out of the tongue of a gentleman.

Mr. BOYLE remarked, that he had seen the like.

Dr. KING related on this occasion, that having opened a gentleman, who died upon strange swooning fits, he found, after long inquiry had been made of the seat of his disease, a small stone on the top on the inside of the *arteria venosa*, depressing the vessel, and thereby hindering the circulation. He was desired to give this relation in writing for the register-book.

There was read another letter from Mr. LISTER to JOHN BROOKE, Esq; dated at York 12th April, 1672 [c], containing an observation about the generation of hair-worms, and shewing, that such things, as are vulgarly thought animated hairs, are very insects, nourished within the bodies of other insects, as *ichneumones* are within the bodies of caterpillars.

[a] A translation of it is printed in the Philosoph. Transact. vol. vii. n° 83. p. 4066.

[b] Letter-book, vol. v. p. 208. It is printed in the Philosoph. Transact. n° 83. p. 4062.

[c] Letter-book, vol. v. p. 215. It is printed in the Philosoph. Transact. vol. vii. n° 83. p. 4064.

There

The lord bishop of Chester affirmed, that he had found the like; which was confirmed by an observation of Mr. BOYLE.

There was read a letter of RICHARD TOWNLEY, Esq; to Mr. OLDENBURG, dated April 15, 1672 [c], containing an observation of his, that if two thermometers, which in his chamber corresponded exactly with each other, one being so placed in a coal-pit as not to be in the way of the current of air, was found by him to have kept above two months at a constant station; whereas during that time the thermometer at home varied very much.

May 8. A book intitled, *A New Years Gift for Dr. Wittie*, by GEORGE TONSTAL, M. D. was presented from the author to the Society. It related to the controversy between them concerning the Scarborough Spaw.

The minutes of the last meeting being read, and Mr. LISTER's letter concerning the production of hair-worms again taken notice of, Mr. WILLOGHBY affirmed, that he had found in all sorts of fishes and birds, which he had opened, as also in some quadrupeds, such worms lying loose in the cavity of the belly, without the guts. He promised to send to the Society the names of all those animals, in which he had found them.

There was read a letter of Mr. NEWTON's to Mr. OLDENBURG, written from Cambridge, May 4, 1672 [d], containing his judgment of Monf. CASSEGRAINE's telescope, like that of Mr. JAMES GREGORY, described in his *Optica Promota*, printed in the year 1663, with a hole in the midst of the optic metal to transmit the light to an eye-glass placed behind it.

Mr. COOK produced a piece of steel polished, to be used in the reflecting telescope.

Mr. HOOKE was desired to make tryal with it, though he said it was falsely polished.

Dr. GREW, the new curator for the anatomy of plants, being present, was desired to produce some observations on that subject at the next meeting; which he promised to do. In order to which it was ordered, that Mr. HOOKE should deliver to him the Society's microscope.

May 15. Dr. GREW made some observations about the secundine, or innermost cover of the seed in plants; of which he produced a description in writing, which was ordered to be registered [e]; as was also the scheme, which he gave in, containing the heads of the most considerable particulars concerning vegetables.

[c] Letter-book, vol. v. p. 227.

[d] Letter-book, vol. v. p. 239. It is printed in the Philosoph. Transact. vol. 5. n° 53. p. 4057.

[e] Register, vol. iv. p. 187. It is published in his Anatomy of Plants, Edit. London, 1682, folio.

Mr. SMETHWICK brought in an inſtrument ſhewing the angles of refraction; and was deſired to draw the figure of it, and to deſcribe the conſtruction and uſes thereof.

Mr. HOOKE made ſome experiments relating to Mr. NEWTON's theory of light and colours, which he was deſired to bring in writing to be regiſtered.

May 22. Signor CASSINI was elected unanimouſly.

Mr. VERNON was likewiſe elected.

The ſecretary was ordered to ſignify to Signor CASSINI his election[g].

Dr. GREW ſhewed the Society, in a microſcope, the conformation of the pith in vegetables, viz. that the whole pith is nothing but a *rete mirabile*, or a wonderful complication of exceedingly ſmall fibres; of which he gave in a larger account in writing, which was ordered to be regiſtered[h].

He was deſired to proſecute this ſubject, in order to find out the uſe of the pith, and to conſider the variety and difference of the piths in ſeveral plants; as in bull-ruſhes, elder, cork, &c. their figures, whether circular or angular; as alſo whether they be always dry or juicy in young plants, &c. Farther, to cut the wood aſunder, and to cut the wood into the pith, to ſee how the plant will grow.

Sir ROBERT MORAY brought in an account of cocao-trees, their planting and culture, the way of curing them, the obſervables in their fruit, &c. tranſmitted to him by Sir THOMAS LINCH from Jamaica; which was ordered to be regiſtered[i].

Mr. HOOKE made ſome more experiments with two priſms, confirming what Mr. NEWTON had ſaid in his diſcourſe on light and colours, viz. that rays of the light being ſeparated by one priſm into diſtinct colours, the reflection made by another priſm doth not alter thoſe colours.

It was intimated by Mr. HOOKE, that theſe experiments were not cogent to prove, that light conſiſts of different ſubſtances or divers powders, as it were; but that theſe phænomena might be explained by the motion of bodies propagated.

Mr. BOYLE produced ſome of the plant *dutroa*, ſent him out of the Eaſt Indies; which is a kind of ſtramonium, and famous for ſo taking away the underſtanding of perſons, that, when they recover, they remember nothing of what they did, or was done before them, during that ſtupefaction.

[g] Mr. OLDENBURG's letter to Signor CASSINI for that purpoſe, was dated 27th May, 1672, and is entered in the Letter-book, vol. v. p. 251.

[h] Regiſter, vol. iv. p. 188. It is publiſhed in his Anatomy of Plants, b. 2. c. 5.

[i] It does not appear in the Regiſter.

He

He mentioned, that he intended to make ſome tryals with it upon dogs, and in particular, whether it be true, that that ſtupor can be taken away in a very ſhort time, and in what quantity it will kill.

The Society adjourned till June 5th, the Wedneſday following being the anniverſary of the king's birth and reſtoration.

June 5. The Society did not ſit: but there was produced before the members preſent, by Mr. CONYERS, a ſpeaking trumpet of a different faſhion from that of Sir SAMUEL MORLAND [k], by a pipe in a pipe rendering the voice by reflection.

He was thanked for the reſpect intended by him to the Society, and acquainted, that at their next meeting they were likely to recommend this contrivance to the examination of ſome of their members.

June 12. At a meeting of the COUNCIL were preſent

Sir ROBERT MORAY, Vice-Preſident,
Sir PAULE NEILE,
Sir THEODORE DE VAUX,
Mr. AERSKINE,
Mr. OLDENBURG.

It was ordered, that Signor MALPIGHI's book, intitled *Marcelli Malpighii Philoſophii & Medici Bononienſis Diſſertatio Epiſtolica de Formatione Pulli in Ovo*, be printed by the printer of the Society; and the form of the licenſe to be as follows;

" Junii 12, 1672.
" In concilio Regiæ Societatis Londini ad ſcientiam naturalem promovendam
" inſtitutæ.

" Tractatus, cui titulus *Marcelli Malpighii Philoſophii & Medici Bononienſis*
" *Diſſertatio Epiſtolica de Formatione Pulli in Ovo*, Regiæ Societati dicata, impri-
" matur a JOHANNE MARTYN, dictæ Societatis typographo."

At a meeting of the SOCIETY on the ſame day Mr. VERNON was admitted.

Dr. GREW ſhewed the Society in a microſcope thoſe *tracheæ* of a ſpiral form, deſcribed by Signor MALPIGHI to be in all vegetables: and of this he gave the deſcription in writing, which was read, and ordered to be regiſtered [l].

Mr. OLDENBURG preſented from the author a book of Dr. SWAMMERDAM, by whom it was dedicated to the Society [m], and intituled *Uteri Muliebris Fabrica, una*

[k] An account of his ſpeaking trumpet, with its uſe both at ſea and land, was publiſhed at London in 1671.

[l] It does not appear in the Regiſter.

[m] In the dedication Dr. SWAMMERDAM declares *neſcire ſe, quo factum ſit fato, ut, quemadmodum Chriſtianus orbis non minima religionis ſuæ incrementa Anglicæ genti debet, ita ultimis difficilimiſque his*

cum Methodo novæ Cavitates Corporis ita præparandi, ut suam semper genuinam faciem servent: Printed at Lyden, 1672, in 4to.

It was ordered, that a letter of thanks be written to him [n], assuring him of the kind reception of his present, and respect.

Mr. OLDENBURG read a letter from Signor MAGALOTTI, dated at Florence, 20th May, 1672, N. S. [o] giving an account, accompanied with a scheme, of a Venetian project of a perpetual lamp made up in a crystal vial with spirit of wine and a wick of gold, so contrived, that supposing the spirit of wine converted from a liquor into smoke, and from smoke into vapour, will turn again into an inflammable liquor, there may be a perpetual circulation, and consequently a perpetual lamp. But several of the members declared, that spirit of wine being once destroyed by the fire will not turn into spirit of wine again.

Signor MAGALOTTI had inclosed in this letter a relation of Dr. GORNIA, physician to the Grand Duke, when the latter was in England, concerning an antient man living in the mountains of Italy, out of whose leg, being ulcerous and neglected, a horn was grown of a considerable bigness.

Mr. OLDENBURG produced Mr. NEWTON's answer to Mr. HOOKE's considerations upon his discourse on light and colours; which answer was read in part, and ordered to be copied for the perusal of Dr. WREN and Mr. HOOKE, and then to be registered [p].

Mr. HOOKE was put in mind to bring in at the next meeting some experiments, that do not depend on the shining of the sun, together with those that require sun-shine.

June 19. Mr. HOOKE's account of some experiments on refractions and colours, lately made by him before the Society, was read, and ordered to be registered [q], as follows:

" In order to examine, whether several colours, after the first refraction, would
" have several refractions, I made several experiments; and the first was, I
" took two prisms, and with the one I cast the rays of the sun upon a wall, at
" a considerable distance; by which means the several colours of the rainbow
" appeared in a line at right angles with that of the prism, viz. red, yellow,

temporibus apud eam inventa sit ratio, quâ, missis inanibus scholasticorum disputationibus, bonæ artes & scientiæ in solido locentur. Quod ipsum, ut non postremam gloriæ Britannicæ partem absolvit, ità in causâ est, ut in naturalis philosophiæ negotio ad nullum aliud quam Regiæ Societatis tribunal provocare vel ausit vel debeat.

[n] Mr. OLDENBURG's letter was dated 1?th June, 1672, and is inserted in the Letter-book, vol. v. p. 275.

[o] This letter was written in English, as appears from Mr. OLDENBURG's answer of 13th June, 1672, Letter-book, vol. v. p. 271.

[p] It does not appear in the Register, but it is printed in the Philosoph. Transact. vol. vii. n° 88. p. 5084, for November 1672.

[q] Register, vol. iv. p. 194.

" green,

" green, blue, and purple: then with a ſecond priſm, placed in a parallelifm " with the aforeſaid line or order of colour, I a ſecond time refracted the rays " of the ſun, or the ſeveral-coloured rays, and thereby found, that all the ſaid " colours would be a ſecond time refracted, and yet keep their ſeveral colours " diſtinct in the ſame order, without very ſenſibly intermingling any other colours " with any of them. Moreover I found, that the ſeveral colours, though they " kept their former order, viz. the ſecond refracted red, yellow, green, blue, " purple, kept the ſame order and poſition with the firſt refracted red, yellow, " green, blue, purple; ſave only, that whereas I held the ſecond priſm in a " parallelifm with the order or line of colours, the colours caſt upon the wall " by this ſecond refraction were not parallel, but aſkew, or oblique; and, upon " examining which was moſt bent from the parallelifm by refraction, I found the " purple, and the reſt leſs, in their order: that is, that the purple was fartheſt " diſtant from the firſt line of refracted colours, and ſo conſequently, according " to the hypotheſis of the differing refraction of colours, purple had the greateſt " refraction, blue the next leſs, green leſs than that, the next yellow, and red " the leaſt of all; which ſeems at firſt much to confirm Mr. NEWTON's theory " of colours and light; but yet I think it not an *experimentuum crucis*, as I may " poſſibly ſhew hereafter.

" Next, I tried a ſecond experiment, by caſting with the firſt priſm the line or " order of colours upon the wall, and taking a black ſtick, and laying it exactly " parallel with the ſaid line, ſo as to touch the upper or under ſide of the ſaid " colours, if the colours were caſt in a horizontal poſture, or the right or left " ſide, if caſt in a perpendicular poſture: then taking a ſecond priſm, and hold- " ing it exactly parallel with the ſtick or the line of colours, and looking through " the ſame, I could plainly ſee the ſtick and the colours; and whereas, with my " naked eye the colours ſeemed juſt to touch the ſtick, and to be parallel there- " with, now they ſeemed to lye aſkew, and the ſtick to paſs through them; and, " which way ſoever the refraction of the ſecond priſm did bend the rays, that way did " the purple bend moſt, and the red leaſt; inſomuch, that I have often obſerved, " that when the colours of the firſt rainbow were caſt above the ſtick, by looking " on them thus, I could ſee them on the other; which at firſt ſeemed not a " little ſtrange.

" Thirdly, I caſt the colours by the firſt priſm upon the floor, or ceiling, or " wall, and with the ſecond priſm held exactly, or, as near as may be, parallel " with the firſt, I looked at thoſe colours, but by ſuch a ſide of the priſm as " refracted the rays quite contrary to their refractions in the firſt priſm; and it " was obvious to ſee, that by turning the ſecond priſm (whilſt in its parallel " poſition) round on its axis gently, the colours on the floor, wall, or ceiling, " would by degrees quite vaniſh and diſappear, and the rainbow (if I may ſo " call the breadth of colours which before poſſibly was almoſt a ſpan breadth " upon the place, contracted itſelf by degrees to the breadth of the firſt priſm; " but if the ſaid rainbow was looked on through the ſecond priſm with a refraction

" the

"the same way with the refraction of the first, the breadth of the same was "very much stretched, and made a span and a half, or two spans, broad.

"Fourthly, I took two thin pieces of glass well plained and polished, the "thinner they are (so they do not break) the better; and putting them one "upon another, I prest them hard together till there began to appear a red-"coloured spot in the middle; then continuing to press them closer, I could "plainly see several rainbows, (as I may so call them,) of colours, encompassing "the first plate; and continuing to press the same closer and closer, at last all "the colours would disappear out of the middle of the circles, or rainbows, and "the middle would appear white; and if yet I continued to press the said plates "together, the white would in several places thereof turn into black. The first "colour that appeared was red, then yellow, then green, then blue, then purple; "then red, then yellow, green, blue, purple; red, yellow, green, blue, purple, and "so onwards: so that I have numbered nine or ten several rainbows, or orders of "colours, one immediately within another, and the red immediately next to the "purple, and the last colour, that appeared before the white, was blue: so that it "began with red and ended with purple, and where there was no other colour pre-"ceded, the red had no purple; but where red was on the one side, and blue on "the other, there was purple; that way, that the red and the blue were dilated, "was yellow, sky-colour, and green; and that way they were heightened was "purple: still the said rings, or rainbows, would vary their places, by varying "the position of the eye, by which they were observed, and not only their posi-"tions, but their colours; so that the glasses remaining the same, that part, "which was red in one posture of the eye, was blue to a second, green to a "third, yellow to a fourth, and purple to a fifth, and other mixt colours to "other postures. Moreover, that, which gives one colour by reflection, gives "another by trajection, not much unlike the tincture of lignum nephriticum. "Of the explication of these phænomena by various hypotheses more hereafter."

Mr. Hooke was desired to make more experiments of the same nature, for a farther examination of Mr. Newton's doctrine of light and colours; especially such as might make it out, that colours may be varied by divers positions of the eye; as also those, that are made with plated bodies, shewing, that the same inclination and the same thickness will give various colours: and farther, those, that shew in a dark room, that where there is no refraction nor reflection, there will be a succession of colours; so that the rays passing only a hole, colours will appear.

Dr. Goddard and Mr. Conyers having brought in several figures for speaking trumpets, and Mr. Hooke having also drawn one for the same purpose, the operator was ordered to attend Dr. Goddard, and to take directions from him for causing such instruments of the produced figures to be made as the doctor should appoint: and Mr. Hooke was desired to make also a tryal of his figure.

Dr. ISAAC VOSSIUS mentioned, that they had a way at Amſterdam of making bells give a much ſweeter ſound than ordinary, retaining the uſual bell form, but employing only half the quantity of the metal, and obſerving a great equality in caſting it.

Mr. OLDENBURG read a letter to him from Mr. HEVELIUS, dated at Dantzick, June 10, 1672 [r], giving notice, that he had printed a diſcourſe of the obſervations of the late comet, made by himſelf, and had ſent ſome copies of it by ſea, to be diſtributed here. This letter was accompanied with a printed ſcheme, repreſenting the motion of the ſaid comet.

June 26. Mr. HOOKE produced a new kind of ſpeaking trumpet figured bell-wiſe, repercuſſing and by degrees dilating itſelf; which being tried, and compared with that of Mr. CONYERS, was found to exceed it.

It was ordered, that againſt the next meeting, a pipe of the form of an ordinary trumpet ſhould be made, widening by degrees in the form of a cone cut off, furniſhed with a mouth-piece.

Dr. GREW ſhewed again in the microſcope the figure of the pith of a common thiſtle, and that of the tracheæ, or ſpiral fibres, of a burdock; of both which he had made a draught.

He was deſired to endeavour to diſcover, whether, whilſt plants are growing, there be a periſtaltic motion in them, as MALPIGHI thought there is; and for that purpoſe to take ſome of the bigger ſort of plants, wherein, if there be any ſuch motion, it is more likely to be found.

Mr. OLDENBURG preſented from Mr. BOYLE his *Eſſay about the origin and virtues of gems*, printed at London, 1672, in 8vo.

Dr. WALTER NEEDHAM produced a letter to him from Mr. TEMPLER, dated March 30, 1671 [s], concerning the ſtructure of the lungs, which from ſeveral experiments ſeemed to him to be a complication of a multitude of the ramifications of the bronchiæ and ſanguineous veſſels, &c.

This gave occaſion to diſcourſe of reſpiration, and of the principal uſe thereof, which Mr. HOOKE ſaid he thought to be, that by the air ſomething eſſential to life might be conveyed into the blood; and ſomething that was noiſome to it, be diſcharged back into the air: and he wiſhed, that means might be uſed to diſcover, whether there are not valves in the arteries, by which the air may paſs into all the parts of the blood. For which purpoſe it was ſuggeſted, that an injection might be made into thoſe veſſels, and particularly into ſome artery, with melted bees wax, mixed with tallow, and coloured, thereby to make the veſſels

[r] Letter-book, vol. v. p. 265.
[s] It is printed in the Philoſophical Tranſactions, vol. vii. n° 86. p. 5031, for Auguſt, 1672.

appear

appear round and full, to see what might be farther discovered in their structure. This was recommended to the physicians of the Society.

Mr. OLDENBURG produced and read a letter to him from Signor CASSINI, dated at Paris, 22d June, 1672, N. S. [t], containing his thanks to the Society for having elected him into their body; and accompanied with a written paper of two sheets in folio, giving an account of his endeavour for settling an hypothesis of the motion of Jupiter and his satellites.

This paper was committed to the perusal and consideration of Mr. HOOKE, who was desired to make a report of it to the Society at their next meeting, especially as the author expressed his desire of having the sense of the Society, or some members thereof, upon the said paper.

July 3. Dr. GREW was put in mind to see, what might be discovered of the peristaltic motion in plants, asserted by Signor MALHIGHI.

Mr. HOOKE was called upon for making a report concerning Signor CASSINI's paper concerning the satellites of Jupiter, and desired to give in writing what he had said upon it, that it might be without mistake imparted to Signor CASSINI, who had desired that favour in his letter.

The speaking trumpet ordered to be prepared for this meeting not being ready, Mr. HOOKE was ordered to take care of having it ready against the next.

Mr. OLDENBURG read three letters written to him, 1. from Signor MALPIGHI, dated at Bologna, 7th June, 1672 [u], containing his sentiments of the ovaria and ova in women, asserted by Dr. de GRAAF and others, whose assertions he thought lightly probable

2. From Dr. SWAMMERDAM, dated 5th July, 1672, giving notice of an anatomical present of some parts of an human body, sent by him to the Society.

3. From Monf. HUYGENS, dated at Paris, 1st July, 1672 [x], containing his thoughts upon Monf. SLUSIUS's last construction of the problem of ALHAZEN, with his own calculus of the same; as also concerning Mr. NEWTON's reflecting telescope, and applauding his new doctrine of light.

Mr. HOOKE upon occasion said, that he found, that a refracting object-glass collected more rays to a point than a reflecting one, both being of the same sphere. He was desired to shew this by an experiment.

July 10. Dr. GREW shewed the insertion of fibres running from the pith into the bark; the description of which he was desired to give in writing.

[t] Letter book, vol. v. p. 307. [u] Letter-book, vol. v. p. 365. [x] ibid. p. 282.

Mr.

Mr. Hooke mentioned, that he had made a refracting object-glass upon the same sphere with a reflecting one, and found, that it represented the object brighter, of the same charge and the same aperture with a reflecting one.

He was desired to shew the experiment of it, by comparing two such glasses together, of the same sphere.

Mr. Hooke gave an account of Signor Cassini's paper, concerning the system of Jupiter and his satellites, importing, that it was considerable, and deserved to have good notice taken of it in the observations of the motions of those stars.

The Society intending to make a recess for some time, the members were desired, that as many of them, as could conveniently, would meet on Fridays in the afternoon, at Gresham-college, to discourse of philosophical matters, and prosecute experiments; among which were recommended

1. Such, as might determine the queries lately sent by Mr. Newton to the Society, which involve his theory of light.

2. Such, as might improve Mr. Newton's reflecting telescope; and particularly to see finished a four-foot telescope of that kind, already recommended to Mr. Cock.

3. Such observations, as might confirm those of Signor Malpighi about the existence of certain tracheæ, or spiral fibres in vegetables, that contain air: as also to endeavour the finding out of that peristaltic motion, which the same author affirmed to have been observed by him in plants.

The Society was adjourned by the president, till such time as his lordship should find a competent number of members in town to meet again.

October 30. The Society began to meet again, after their recess since 10th July.

Henry lord Howard of Castle-Rising was proposed by the lord bishop of Chester, and, on account of his quality, was immediately put to the ballot, and elected unanimously, and admitted.

Thomas Howard, Esq; second son to the earl Marshall [y], was proposed candidate by the lord bishop of Chester.

Mr. Ashmole presented to the Society his *History of the Order of the Garter.*

[y] Henry lord Howard was created earl of Norwich, and had, by the same patent, the grant of the office of earl Marshall, 29th October, 1672.

There were also presented JOHANNIS HEVELII *Epistola de Cometa*, 1672, *mense Martio*.

MALPIGHI's *Dissertatio Epistolica de Formatione Pulli in Ovo*, Printed at London, 1672, in 4to.

Mr. HOBBES's *Lux Mathematica Collisionibus* JOHANNIS WALISII. S. TH. D. & THOMÆ HOBBESII *Malmesburiensis excussa; multis & fulgentissimis aucta radiis; Authore R. R. adjuncta censura Doctrinæ Wallisianæ de Libra, una cum* ROSETO HOBBESII. Printed at London, 1672, in 4to. And

JEREMIÆ HOROCCII *Angli Opera Posthuma; una cum* GARIÆ CRABTRÆI *Observationibus Cœlestibus; nec non* JOH. FLAMSTEDII *de Temporis Æquatione Diatriba numerisque Lunaribus ad novum Lunæ Systema Horroccii*. Printed at London, 1672, in 4to.

It was ordered, that Mr. HEVELIUS, Signor MALPIGHI, and Mr. HOBBES should be thanked by the secretary for their respect to the Society, with an intimation that their books were committed to the perusal of some of the members.

The examination of what had been done concerning the queries of Mr. NEWTON, to be determined by experiments, concerning his theory of light, was referred to the next meeting.

An account being demanded of what trials had been made for the improvement of the reflecting telescope of Mr. NEWTON, Mr. HOOKE said, that hitherto he had wanted a mould of a sufficient bigness for a speculum, designed by him, of fifteen inches diameter, for a tube of ten feet long; but that he hoped to have, in a week or fortnight, such a mould cast, wherein a speculum of that bigness might be well wrought and polished.

Since during the Society's recess there had been communicated to the members, who then met at Gresham-college, Monf. HUYGENS's conjecture about the odd phænomenon of the mercury's standing top-full of well cleansed air, even to the hight of seventy-five inches; and since the president and Dr. WALLIS had suggested divers experiments determining the cause of that effect; it was inquired what had been done in this matter? Mr. HOOKE answered, that some trials had been made about it; and that he would bring in an account of them in writing against the next meeting.

Dr. GREW being called upon, for an account of the observations, which he had made in vegetables, produced a good number of such observations, made upon the roots of several plants, of which he exhibited the figures, both as the objects appeared to the naked eye, and by the microscope. He was desired to bring in a description of all these in writing, to be registred.

He was exhorted likewise to finish two or three plants, in all their parts, after this exact manner, to be printed early, before they were arrogated by strangers.

Two letters of Mr. LISTER to Mr. OLDENBURG, dated at York, one of the 10th of October, 1672, inlarging and correcting his former notes about kermes; and the other of 23d October, concerning land and fresh-water snails, with some queries relating to them, were read, and ordered to be inserted in the Letter-book [a].

November 6. Mr. THOMAS HOWARD of Norfolk was elected and admitted.

Mr. HOOKE read a discourse of his, containing his thoughts of the experiment of the quick-silver's standing top-full, and far above the hight of twenty-nine inches; together with some experiments made by him, in order to determine the cause of this strange phænomenon. He was ordered to prepare those experiments for the view of the Society.

There was also read a letter of Dr. WALLIS to Mr. OLDENBURG, dated at Oxford October 25th, 1672 [a], suggesting divers experiments for the elucidation of the same phænomenon: which letter was delivered to Mr. HOOKE.

Two other letters were likewise read, both written by Mr. HEVELIUS to Mr. OLDENBURG from Dantzick, dated September 16, and October 29, 1672, concerning the eclipse of the sun, on the 11th of August, N. S. and the phasis of Saturn on the 19th of October: as also the re-appearance of the new star in the neck of the Swan [b].

Mr. HOOKE produced two books, one intitled, *Ottonis de* GUERICKE *Experimenta nova Magdeburgica de vacuo spacio, &c.* printed at Amsterdam, 1672, in fol. and Dr. MORHOFF's *Epistola de Scypho vitreo per certum humanæ Vocis sonum rupto*, moving, that they might be bought by the Society for their libraries; which was agreed to.

He mentioned, that among Mr. GUERICKE's experiments there was one which he thought deserved to be tried before the Society, viz. that of a sulphur-ball having a considerable attractive power, and representing the properties of the earth.

Mr. LOCKE intimated, that himself had made some experiments with such a ball, and promised, that he would bring it to the Society at the next meeting.

[a] Vol. v. p. 348. and 351. The former of these letters is printed in the Philosoph. Transact. vol. vii. n° 87. p. 5059.

[a] Letter-book, vol. v. p. 389. An abstract of this and other letters of Dr. WALLIS's on that subject is printed in the Philosoph. Transact. n° 91. p. 5160, for February, 167 2/3.

[b] Letter-book, vol. v. p. 356.

There were read two letters more to Mr. OLDENBURG, the one from Mr. HENSHAW, dated at Copenhagen, July 6, 1672 [c], concerning his care of the philosophical concerns of the Society in Denmark, and giving some account of OLAUS WORMIUS's book, *De Mure Norvagico*; the other of Dr. ERASMUS BARTHOLIN, dated likewise at Copenhagen, 4th August, 1672 [d], giving an account of the performances of Monf. PICART, the Parisian astronomer, in Denmark, and particularly in the isle of Huenna, &c.

Mr. TOWNLEY's figure, representing a thermometrical experiment of his, made at a considerable depth under ground, was ordered to be drawn large by the amanuensis, against the next meeting.

November 13. At a meeting of the COUNCIL were present,

The president,
The lord viscount STAFFORD,
Mr. AERSKINE,
Sir ROBERT MORAY,
Sir PAUL NEILE,
Sir THEODORE de VAUX,
Dr. GODDARD,
Mr. COLWALL,
Mr. OLDENBURGH.

A committee of the council, for auditing the treasurer's accounts, was appointed, consisting of the president, Sir THEODORE de VAUX, Dr. GODDARD, Dr. WALTER NEEDHAM, and Mr. OLDENBURG.

It was ordered, that the treasurer pay quarterly all the salaries payable by the Society till further orders: and that what copies of Signor MALPIGHI's dissertation *De Formatione Pulli in Ovô*, the printer would not furnish for the author gratis, should be paid for by the Society, who had lately ordered thirty copies of it to be sent to him to Bologna.

At a meeting of the SOCIETY the same day,

Sir ROBERT MORAY presented to the Society, for the repository, a bee-hive of a peculiar contrivance, sent out of Scotland by Sir WILLIAM THOMSON, made up of several pieces, to take off one; whereby bees are kept from swarming, by adding a new box for every swarm.

The experiment about the high suspension of quick-silver being called for, it was found, that it had failed. It was ordered, that thicker glasses should be provided for the next meeting.

Mr. HOOKE having made a report concerning the experiments suggested by the president and Dr. WALLIS, it was ordered, that the president's experiments not being rightly made, nor that of Monf. HUYGENS with a syphon, they should both be made before the Society, as soon as possible:

[c] Letter-book, vol. v. p. 292. [d] Ibid. p. 367.

Mr.

Mr. Hooke proposed a method of making the same experiment with a syphon in the open air, by double pipes, and by blowing them both into one ball. He was desired to make use of this contrivance.

Mr. Locke being called upon for his sulphur-ball, which he promised at the last meeting to produce at this, excused himself, that he had forgot it, promising to bring it at the next.

Mr. Hooke suggested, that it were worth trying, whether air be consumed, or increased by burning. He was desired to devise some experiments for determining this question.

Mr. Boyle moved, that it might be tried, to make air of finer bodies than ordinary, such as are distilled liquors, or chemical salts in distilled liquors, in order to find, whether or no such air will be more compressed by force than common air.

He moved also, that it might be examined, whether, in making salt-petre by art, there is any air intercepted and compressed.

November 20. A committee was nominated and chosen for auditing the accounts, consisting of Sir John Lowther, Mr. Hoskyns, Mr. Hooke, Mr. Hill, and Mr. Locke; of whom three were to be a quorum. They agreed to meet at Arundel-house on that day se'nnight, some time before the sitting of the Society.

An attempt was made of an experiment to discover, whether there be any air generated or consumed by burning, or neither: which not succeeding, it was thought proper, that it should be tried on the Saturday following, at Mr. Hooke's lodgings in Gresham-college, before such members of the Society, as used to meet there, and the success of it reported to the next public meeting.

An experiment was made, to shew, that water in a tube, open at both ends, will, when lifted up, stand at eight inches, before it begins to fall. Mr. Hooke was desired to describe the contrivance of this experiment, to be registred.

Three letters to Mr. Oldenburg were read;

1. Of Mr. Flamstead, dated at Derby, 17th November, 1672, accompanied with his calculations of the appulses of the moon and the other planets to fixt stars, for the year 1673 *.

* They are printed in the Philosoph. Transact. vol. vii. n° 89. p. 5118. for Decem. 1672.

2. Of

2. Of Mr. LISTER, dated at York, 15th November, 1672 [f], concerning an uncommon kind of mushroom, yielding a milky juice, much hotter upon the tongue than pepper.

3. Of Monf. John HECKER, an astronomer of Dantzick, dated there 20th September, 1672 [g], expressing a singular esteem of the institution of the Society, and intimating his having sent a written paper about a conjunction of Mercury with the sun; which paper had not yet been received.

The president suggested upon occasion, that Mr. HEVELIUS should be asked, when Mr. OLDENBURG wrote to him, whether he did not use a telescope with his quadrants and sextants in lieu of lights?

It was moved, that Mr. LISTER might be desired to send to the Society his opinion of the veins in plants, which he seemed willing to impart at the end of his letter of the 15th of November, in these words [h]: "The season is almost "over, so that the account, which we can give of the veins in plants, must rest "as it is, until farther opportunity. My sense of these veins, according to the "experience I have yet of them, you may command. But what I chiefly aimed "at, I have found exceeding difficult to effect; that is, an ocular demonstra-"tion of them: yet, in some measure, I have attained to that also."

Mr. HOOKE intimated, that the great tool for grinding the reflecting glass was now ready; and he was exhorted to put it to the trial, and to report the success to the Society.

November 27. At a meeting of the COUNCIL were present

Sir ROBERT MORAY, vice-president,

The earl Marshal,	Sir THEODORE de VAUX,
The lord viscount STAFFORD,	Mr. COLWALL,
Mr. AERSKINE,	Mr. CREED,
Sir PAUL NEILE,	Mr. OLDENBURG.

The committee of the council for auditing the treasurer's accounts made the following report:

"At a committee of the council of the Royal Society for auditing the trea-"surer's accounts, November 23, 1672, upon examination of Mr. DANIEL COL-"WALL's accounts we find he is debtor,

[f] Letter-book, vol. v. p. 395. It is printed in the Philosoph. Transact. n° 89. p. 5116.

[g] Letter-book, vol. v. p. 340.

[h] They are omitted in the copy printed in the Philosoph. Transact.

"To

	l.	s.	d.
"To the arrears due to the said Society for their quarterly "payments this 23d November, 1672 - - - -	1957	12	0
"To monies he hath received for admissions - - - - -	20	15	0
"To the balance of his last account - - - - - -	10	10	6
	£ 1988	17	6

"We also find he is creditor

"By monies he hath paid for the use of the Society, as by "vouchers doth appear - - - - - - - -	163	1	3
"By arrears yet unpaid by the fellows of the Society - -	1818	7	0
"By balance resting in cash in his hand - - - -	7	9	3
	£ 1988	17	6

The council finding the vast arrears of many fellows of the Society, ordered, that once again a list should be drawn up by the amanuensis of those, who are most behind in payment; and that thereupon such persons should be sollicited to pay by those, who had proposed them for candidates: and that this should be done against the next meeting of the council.

At a meeting of the SOCIETY on the same day, Mr. BOYLE produced a ball of sulphur melted in a glass ball, which, like electrical bodies, attracted several light substances, as also filings of fine copper. He shewed, that feathers being first attracted by this sulphur-ball would leave this electrical body, and pass to one not electrical, untouched, as to a glass-phial.

Mr. HOOKE produced and read a discourse of his own, containing divers optical trials made by himself, which seemed to discover some new properties of light, and to exhibit several phænomena, in his opinion not ascribable to reflection, or refraction, or any other till then known property of light.

He was desired to pursue these experiments in a convenient season, and to deliver in to the Society some account of what was done on this subject, to be registered, to preserve his discoveries from being usurped.

He made an experiment to find out, whether air increases or decreases by burning: but the success not proving satisfactory, he was desired to repeat the experiment at the next meeting.

He being called upon concerning the large tool for grinding the reflex glass, said, that he had tried the said tool so far, as to find it pretty just.

Mr.

Mr. BOYLE upon occasion moved, that some true naphtha might be procured, to see, whether it would burn under water, he having found, that what is commonly brought to England for naphtha, does not so.

November 30. The report of the committee of the Society for auditing the accounts was made as follows:

" At a committee of the Royal Society for auditing the treasurer's accounts, " November 27, 1672,

" We find Mr. DANIEL COLWALL, the treasurer, debtor,

	l.	s.	d.
" To monies he hath received on the quarterly payments of the " Society from 21st November, 1671, to 23d November, 1672,	139	5	0
" To money he hath received for admissions - - - -	20	15	0
" To balance of his last account of 21st November, 1671, - -	10	10	6
	£ 170	10	6

" We also find he is creditor,

" By monies he hath paid for the use of the Society, as his " vouchers make appear, - - - - - - - -	168	1	3
" By balance resting in his hands - - - - - -	7	9	3
	£ 170	10	6

" J. LOWTHER, " A. HILL,
" JOHN HOSKYNS, " ROBERT HOOKE."

The Society then proceeded to the election of a new council and officer, and there were continued of the council these eleven;

The Lord Visc. BROUNCKER,
The Earl Marshal,
The Lord Visc. STAFFORD,
The Lord Bishop of SALISBURY,
The Lord BERKLEY,
Mr. AERSKINE,
Sir ROBERT MORAY,
Sir PAUL NEILE,
Dr. GODDARD,
Mr. COLWALL,
Mr. OLDENBURG.

The ten members of the council were,

The Earl of DORSET,
Mr. CHARLES HOWARD,
Sir JOHN LOWTHER,
Mr. EVELYN,
Mr. HILL,
Mr. HOSKYNS,
Mr. PEPYS,
Dr. ARDERNE,
Dr. CROUNE,
Mr. LOCKE.

For

For officers were chosen

The Lord Visc. BROUNCKER, President,	Mr. EVELYN and Mr. OLDENBURG } Secretaries.
Mr. COLWALL, Treasurer,	

Of ten new members of the council were present and sworn,

The Earl of DORSET,	Mr. HOSKYNS,
Mr. CHARLES HOWARD,	Mr. PEPYS,
Sir JOHN LOWTHER,	Dr. ARDERNE,
Mr. HILL,	Dr. CROUNE.

Between this and the preceding anniversary election, the Society had lost three of its eminent members, MATTHEW WREN, Esq; FRANCIS WILLUGHBY, Esq; and JOHN WILKINS, D. D. lord bishop of Chester.

MATTHEW WREN, Esq; eldest son of Dr. MATTHEW WREN, bishop of Ely, was born August 20, 1629, in Peter-House, Cambridge [i], of which his father was then master. His first education was in that university, whence he removed to that of Oxford, where he was a student, not in a college or hall, but in a private house [k]. In 1657 he published at London, in 8vo, *Considerations on Mr.* HARRINGTON's *Commonwealth of Oceana, restrained to the first part of the Preliminaries.* Mr. HARRINGTON answered this discourse in the first book of his *Prerogative of Popular Government*, printed at London in 1658, 4to, in which he reflects on Mr. WREN as one of those virtuosi, who then met at Dr. WILKINS's lodgings at Wadham-College, the seminary of the Royal Society, and describes them as an assembly of men, who *had an excellent faculty of magnifying a louse, and diminishing a commonwealth.* Mr. WREN replied, in his *Monarchy asserted: or, The State of monarchical and popular Government, in vindication of the* Considerations on Mr. HARRINGTON's Oceana; printed at London, 1659, in 8vo. Mr. HARRINGTON's rejoinder was an indecent piece of buffoonry, unworthy of his character, intitled *Politicaster: or, a Comical Discourse in answer to Mr.* WREN's *book intituled* Monarchy asserted, &c. London, 1659, in 4to. Sir EDWARD HYDE, in 1659, was very sollicitous, that Mr. WREN would undertake an answer to Mr. HOBBES's Leviathan [l].

At the restoration he was elected burgess of St. Michael in Cornwall to serve in the parliament, which began at Westminster, May 8, 1661, and was appointed secretary to the Earl of CLARENDON, lord high chancellor of England, who visiting the university of Oxford, of which he was chancellor, in September 1661, Mr. WREN was created there master of arts. He was one of the first members of the Society, when they began their weekly meetings at London, in

[i] Bishop WREN's larger Diary, printed in the Parentalia: or Memorials of the Lives of MATTHEW WREN, bishop of Ely, &c.

[k] WOOD, Fasti Oxon. vol. ii. col. 143.

[l] Appendix to the Life of Dr. BARWICK. Letters of Sir EDWARD HYDE, of June 27, and July 25, 1659.

1660. After the fall of his patron, the Earl of CLARENDON, he became secretary to JAMES Duke of YORK, in whose service he continued till his death, about the 11th of June, 1672. His body was interred in the same vault with that of his father, in the chapel of Pembroke-hall, at Cambridge.

FRANCIS WILLUGHBY, Esq; was descended of two very ancient families, both WILLUGHBYS, the one honourable, that of Eresby in Lancashire, by the father's side; the other worshipful, that of WILLUGHBY on the Woulds in Nottinghamshire, on the mother's [m]. He was only son of Sir FRANCIS WILLUGHBY, knight, by the lady CASSANDRIA, daughter of THOMAS RIDGWAY, earl of Londonderry in Ireland, and was born about the year 1637 [n]. His education was at Trinity-college in Cambridge, under Dr. JAMES DUPORT, afterwards dean of Peterborough, who dedicated to him and to Mr. EDWARD CECIL, Mr. JOHN KNATCHHALL and Mr. HENRY PUCKERING, his *Homeri Gnomologia*, printed at Cambridge in 1660, in 4to. In September, 1660, he resided at Oxford for the sake of the publick library [o]. On the 20th of November the year following, he was proposed candidate of the Royal Society by Dr. WILKINS, and being elected, was admitted on the 11th of December. He set out on his travels abroad in April, 1663, in company with NATHANIEL BACON, Esq; and Mr. RAY, and visited the Low Countries, Germany, Italy, France, and Spain, to which last country he went in August, 1664, his account of his travels there being printed at the end of those of Mr. RAY in 1673. While he was young, his relations discovered in him most excellent gifts and abilities both of body and mind; and therefore nothing was spared by them to promote and enlarge them; and with these he enjoyed the advantage of a plentiful estate, to which he succeeded in 1665, on the death of his father, He had been from his childhood addicted to study; and when he came to the use of reason he was so frugal of his time, that he did not willingly lose, or let slip unemployed, the least part of it, detesting no vice more than idleness, which he looked upon as the parent and nurse of almost all others. And his application to his studies, without any intermission or diversion, was thought by most of his friends to have impaired his health. He attained very great skill in all parts of learning, even those of the most abstruse kind, especially mathematical; in which science he corresponded with his incomparable friend Dr. ISAAC BARROW, two of whose letters to him are published [p]. His knowledge of natural philosopy, and particularly the history of animals, was superior to that of most of his age: and his moral qualities of modesty, sobriety, justice, and generosity, were no less eminent than his intellectual ones. He died July 3, 1672, aged 37 years, and left, by his wife EMMA, daughter of Sir HENRY BERNARD, knight, two sons, FRANCIS, and THOMAS, afterwards created a baronet 7th April 1677; and in January, 1711, lord MIDDLETON; and a daughter, CASSANDRA, second wife to JAMES duke of CHANDOS. His writings, besides these printed in the *Philosophical Transactions*, are *Ornithologiæ libri tres*; *in quibus aves omnes hactenus cognitæ in methodum naturis suis convenientem redactæ accurate*

[m] Mr. RAY's preface to Mr. WILLUGHBY's *Ornithology*, London, 1678, folio.

[n] He was 37 years old at his death in 1672.

[o] Wood, Fasti Oxon. vol. 2. col. 139.

[p] Philosophical Letters of Mr. RAY, &c. p. 360, 362.

descri-

deſcribuntur, deſcriptiones iconibus elegantiſſimis, & vivarum avium ſimillimis, æri inciſis illuſtrantur: London, 1676, in folio, reviſed, corrected, and digeſted into order by Mr. JOHN RAY, who afterwards tranſlated it into Engliſh, and publiſhed it with an appendix, at London, in 1678.

De Hiſtoria piſcium libri quatuor, juſſu & ſumptibus Societatis Regiæ, Londini editi. Totum opus recognovit, coaptavit, ſupplevit, librum etiam primum & ſecundum integros adjecit Joannes Raius e Societate Regia. Oxford, 1686, folio.

JOHN WILKINS, D. D. lord biſhop of Cheſter, ſon of Mr. WALTER WILKINS, citizen and goldſmith of Oxford, was born at Fawkeſly near Daventry in Northamptonſhire, in the houſe of his mother's father, Mr. JOHN DOD, the celebrated puritan miniſter, about the year 1614 [q]. Having been educated in grammar learning under Mr. EDWARD SYLVESTER, who taught a private ſchool in Allſaints pariſh in Oxford, he was entered a ſtudent in New-inn, in Eaſter term, 1627; and after a ſhort ſtay there was removed to Magdalen-hall, under the tuition of Mr. JOHN TOMBES [r], and as a member thereof, October 20, 1631, took the degree of batchelor of arts [s], and, June 11, 1634, that of maſter [t]. Upon entering into holy orders, he became chaplain to WILLIAM lord viſcount SAY and SELE, and afterwards to CHARLES elector Palatine, with whom he continued for ſome time. In 1638 he publiſhed at London, in 8vo. his *Diſcovery of a new World: or a Diſcourſe tending to prove, that it is probable there may be another habitable World in the Moon*; to which was added, *a Diſcourſe concerning the poſſibility of a paſſage to the World in the Moon.* In 1640, another performance of his was printed at London, in 8vo. under the title of *a Diſcourſe concerning a new planet; tending to prove, that it is probable our Earth is one of the Planets.* Theſe three diſcourſes were publiſhed without his name. His next work was printed at London, 1641, in 8vo. and intitled *Mercury: or the ſecret Meſſenger; ſhewing how a man may with privacy and ſpeed communicate his thoughts to a Friend at any Diſtance.* In 1646 he publiſhed at London, in 8vo. his *Eccleſiaſtes: or Diſcourſe of the Gift of preaching, as it falls under the rules of art*; and in 1648, his *Mathematical Magic: or the Wonders, that may be performed by mechanical Geometry*; London, in 8vo. Having, after the breaking out of the war between king CHARLES I. and the parliament, taken the covenant, he was, April 13, 1648, made warden of Wadham College in Oxford, in the room of Dr. JOHN PITT ejected by their authority, having been the day before created batchelor of divinity [u], as he was doctor, December 18, 1649 [x]. The ſame year he publiſhed at London in 12mo. his *Diſcourſe concerning the Beauty of Providence in all the rugged paſſages of it*; and, in 1653, at London, in 8vo. his *Diſcourſe concerning the Gift of Prayer; ſhewing what it is, wherein it conſiſts, and how far it is attainable by induſtry, &c.* About the year 1656, he married ROBINA, ſiſter of the protector, OLIVER CROMWELL, and widow of Dr. PETER FRENCH, canon of Chriſt church; which marriage being contrary to the ſtatutes of Wadham College, which prohibited the warden from marrying, he obtained a diſpenſation from the protector

[q] Mr. WOOD, Athen. Oxon. vol. ii. col. 505. ſays, that he was 13 years of age in 1627.
[r] Id. ibid.
[s] Id. Faſti Oxon. vol. i. col. 252.
[t] Id. ibid. col. 260.
[u] Id. Athen. Oxon. vol. ii. col. 505.
[x] Id. Faſti Oxon. vol. ii. col. 91.

to hold the wardenship notwithstanding. In the beginning of 1659, by the favour of RICHARD CROMWELL, the protector, he was preferred to the mastership of Trinity college in Cambridge, on the death of Dr. JOHN ARROWSMITH. But being ejected thence the year following about the time of king CHARLES II's restoration, he became preacher to the honourable society of Grey's Inn [y], and rector of Cranford in Middlesex, December 10, 1661 [z], in the room of Dr. THOMAS FULLER, deceased, to which living Dr. WILKINS was presented by GEORGE lord BERKLEY; as he was, April 11, 1662, to the vicarage of St. Laurence Jury in the city of London, by the king, on the promotion of Dr. SETH WARD to the bishopric of Exeter [a]. March 11, 1663, he resigned the rectory of Cranford; and was afterwards promoted to the deanry of Rippon in Yorkshire, and made prebendary of Chamberlain-wood in the cathedral of St. Paul's, March 26, 1667 [b]. His excellent *Essay towards a real Chrvacter and a philosophical Language* was printed at London 1668, in folio, with a dedication to the Royal Society. The same year he was advanced to the bishopric of Chester, to which he was consecrated, November 15. He had been one of that assembly of learned men, who met as early as 1645, and continued their meetings at London and Oxford, till they were formed into the Royal Society, of which he was nominated in the charter one of the two secretaries, and held that office till his promotion to the bishopric of Chester. He died of the stone at the house of Dr. TILLOTSON in Chancery-lane, who married his wife's daughter, on the 19th of November, 1672, and was interred on the 12th of December following under the north wall of the chancel of the church of St. Laurence-jury, where his funeral sermon was preached by his learned friend, Dr. WILLIAM LOYD, dean of Bangor, in which the bishop's character is represented in a strong and beautiful light. By his last will he left a legacy of two hundred pounds to the Royal Society, and his papers to Dr. TILLOTSON, who published from them a discourse *of the Principles and Duties of natural Religion*, printed at London, 1675, in 8vo. and a volume of *sermons*, fifteen in number, printed there in 1682, in 8vo.

December 4. The experiment to find, whether air increases or decreases, being called for, Mr. HOOKE affirmed, that he had found, that it neither increased nor decreased. A trial of this being made before the Society, it miscarried, and was therefore ordered to be repeated at the next meeting.

Mr. OLDENBURG produced and read a letter to him from Mr. LISTER, dated at York, November 30, 1672, concerning veins and other curious observables in plants, and particularly of the liableness of all vegetable juices to be frozen, except the milky one.

It was ordered to be entered into the Letter-book [c], and to be communicated to Dr. GREW for his perusal and consideration, who was desired to bring in his

[y] Id. Athen. Oxon. *ubi supra.*

[z] It is 1660 in NEWCOURT's Repertorium, vol. i. p. 596: but that must be a mistake, since that rectory was not vacant till Dr. THOMAS FULLER's death, on the 5th of August, 1661.

[a] Ibid. p. 387.

[b] Ibid. p. 136.

[c] Letter-book, vol. v. p. 397.

remarks

remarks upon the same, and particularly to try in a convenient season the freezing of vegetable juices.

Mr. Hooke being called upon about the giving in the heads of his late discourse concerning some new properties of light to be registered, promised, that upon farther prosecution of that subject he would bring in the whole.

He gave hopes likewise, that he might be able to bring in the large reflex speculum at the next meeting.

December 11. Dr. Grew brought in his remarks upon Mr. Lister's letter of November 30, 1672, concerning the veins in plants; which remarks were ordered to be entered into the Letter-book [d], and to be formed into quæries to be communicated to Mr. Lister for his farther consideration.

Mr. Schroter produced two letters in Latin to the Society, delivered to him lately in Germany, by one Dr. Salomon Reisel, archiater to Frederic Casimir count of Hanaw, the one dated 30th September, the other 1st October, 1672; the former containing a relation concerning many capital letters found in both sides of a piece of beech-tree, cleft asunder, between the pith and bark; the latter discoursing about some vulgar errors. Which letters were ordered to be entered in the Letter-book [e].

Mr. Schroter shewed the Society a human skull every where very curiously overgrown with moss; as also two telescopes made in Germany, one of which consisting of two tubes connected, and lying parallel to one another, was to serve both eyes at once, yet so as to represent the object single. Monf. Schroter was desired to bring them again to the next meeting, that they might be viewed by daylight.

December 18. At a meeting of the Council were present,

The president,	Mr. Colwall,
The lord viscount Stafford,	Dr. Goddard,
Mr. Charles Howard,	Dr. Croune,
Sir John Lowther,	Mr. Pepys,
Sir Paul Neile,	Mr. Locke,
Mr. Hill,	Mr. Oldenburg.

Mr. Locke was sworn as one of the council.

Mr. Oldenburg mentioning Dr. Grew's desire to be informed, whether the Society would farther employ him in the anatomy of plants upon the former terms; it was declared that the council and Society well approved of what he

[d] Vol. v. p. 405. [e] Ibid. p. 415. & 418.

had

had hitherto performed; and that the council would farther recommend him to the Society, to continue him another year, if the subscribers would please to continue their contributions.

Sir PAUL NEILE representing to the council the strange neglect of Chelsea-college, and the reproaches thence falling on the Society, it was referred to Sir ROBERT MORAY, Sir PAUL NEILE, Dr. CROUNE, and any others of the council, who had opportunity, to discourse with Dr. WREN, the surveyor-general, and others, about letting out the said college to be built for a certain number of years.

It was ordered likewise, that Mr. HOSKYNS should be desired to satisfy the council about the nature of the land belonging to Chelsea-college, viz. whether it be Lammas-ground or not?

Sir PAUL NEILE moved anew, that considering the vast arrears due to the Society, the fellows thereof might by a legal tie be obliged to payment: and it being resolved, that as good council, as could be had, should be advised with, whether the obligation already subscribed by the fellows did not amount to such a legal tie? the lord viscount STAFFORD offered, that he would undertake to inquire accordingly of the best lawyers, whom he knew, and thereupon satisfy this council at their next meeting.

His lordship's offer was accepted, with thanks, and Mr. OLDENBURG was ordered to cause a copy to be made of the said obligation; and also of the statutes concerning the payments in general terms included in that obligation, and to send that copy to his lordship.

The amanuensis was ordered to go to the prerogative-court, and to copy out of the last will of the late Dr WILKINS, bishop of Chester, what the legacy is, which he had bequeathed to the Society.

The council declared, that in the absence of the president and vice-president at the public meetings, the members present shall nominate some of their number to take the chair.

December 18. Mr. HOOKE, the curator being absent, by reason of sickness, there were no experiments made at this meeting.

A letter of Monf. SLUSIUS to Mr. OLDENBURG, dated at Liege, December 6, 1672 [f], in answer to one of Mr. OLDENBURG's of November 11. was read [g], concerning the optical problem of ALZAHEN; as also the suspension of purged quick-silver at seventy five inches.

[f] Vol. v. p. 407. [g] Ibid. p. 359.

Mr.

5

Mr. OLDENBURG produced an anatomical present to the Society from Dr. SWAMMERDAM, physician at Amsterdam, consisting of the following particulars:

1. An *uterus humanus*, prepared after the method of Dr. SWAMMERDAM, with all the other parts dried up, and the vessels filled with yellow and red wax, very distinctly injected, after the manner described by the doctor, in his book accompanying his present, intitled, *De uteri muliebris fabrica*, dedicated to the Society.

2. *Pudendum Virgineum, cum Hymene.*

3. *Clitoridis Portiuncula.*

4. *Penis & Urethræ Portiuncula.*

5. *Urethræ Portiuncula.*

6. *Intestini jejuni Valvulæ conniventes, a* RUYSCHIO *observatæ, a* KERCKRINGIO *delineatæ.*

7. *Intestini Rajæ cochlea, a* STENONE *descripta.*

8. *Lymphaticum peculiare ex abdomine Gallinæ.*

9. *Arteria primi generis, seu pulmonalis in Piscibus, per quam sanguis ad branchias amandatur.*

10. *Arteria secundi generis in Piscibus, per quam sanguis e ramis branchialibus immediate per totum Corpus distribuitur.*

11. *Humani Lienis Arteriæ & Venæ.*

12. *Insignes Arteriæ Hepaticæ Rami una cum Vesicula fellis.*

13. *Arteria Lienis vitulini.*

The Society being well-pleased with this present, ordered Mr. OLDENBURG, to write a letter to Dr. SWAMMERDAM[h], and to return him their solemn thanks, and to signify to him their high sense of his regard, shewn to them by so valuable a present.

The Society adjourned to January 8 following, on account of the ensuing festival.

[h] Mr. OLDENBURG's letter to Dr. SWAMMERDAM, in Latin, dated at London, 19th December, 1672, is entered in the Letter-book, vol. v. p. 414.

167$\frac{2}{3}$, *January* 8. The *Philosophical Transactions* for December, 1672, containing the predictions of Mr. FLAMSTEAD of the appulses of the moon to the fixed stars for the year 1673, were delivered to Mr. HOOKE, in order that those appulses might be observed.

Mr. OLDENBURG read a letter to himself from Dr. FRANCIS de la BOE SYLVIUS, dated at Leyden, $\frac{17}{27}$ September, 1672, having been long detained by the person, who had been intrusted with it. It contained his request of the Society's judgment, concerning his *Praxeos Medicæ Idea Nova*. It was ordered to be entered in the Letter-book [i].

Mr. OLDENBURG presented likewise a copy of the second edition of Dr. SYLVIUS's *Idea Medicinæ Practicæ*.

There was produced to the Society a discourse of Dr. GREW, concerning his whole design with respect to vegetables, and the means of effecting it. Part of this discourse was read, to the great satisfaction of the Society, who urged the publication of it [k]; and the rest was ordered to be read at the next meeting.

Mr. HOOKE was desired to prepare some experiments for the next meeting.

January 15. The second part of Dr. GREW's design concerning vegetables was read, and he received the thanks of the Society for his care of improving that part of natural philosophy, and was again encouraged to proceed to make it public.

The Society considering likewise, that this prosecution of the anatomy of plants was very suitable to their design, and that Dr. GREW was very fit to be farther employed therein, ordered, that Mr. COLLINS should be desired to attend the several subscribers for a contribution to this work, and from the Society recommend to them the continuance thereof.

Mr. OLDENBURG read a letter to him from Mr. HENSHAW, dated at Copenhagen, 12th December, 1672, containing his observations of some curiosities met with in that place, and expressions of his care, in recommending the queries for Iceland, and the isles of Fero.

January 22. Mr. COLWALL presented a mathematical book, in folio, being the work of GREGORY de SANCTO VINCENTIO *De Quadraturâ Circuli*.

Mr. HOOKE produced an essay of a reflecting objective speculum, being the segment of a sphere of thirty six feet, which he hoped, when perfectly polished, would perform as much as a refracting object-glass for an hundred feet tube. He was desired to see it brought to perfection.

[i] Vol. v. p. 382.
[k] It was published at London in 1673, in 8vo, under the title of *An Idea of a phytological History propounded*, &c.

Mr. Boyle fent a liquor, which had the power of fo hardening foft bread in two or three minutes, that the bread made the glafs, wherein it was held, ring when hit againft it.

It was ordered, that he fhould be defired to inform the Society, what kind of liquor it was.

Mr. Oldenburg produced a letter to himfelf from Signor Malpighi, dated at Bologna, 8th October, 1672 [1], accompanying a difcourfe, containing his repeated obfervations upon eggs, whereby he partly confirmed and illuftrated the former difcourfe, and communicated further difcoveries on that fubject.

At this meeting was prefent Monf. Leibnitz, the author of the printed difcourfe, intitled, *Hypothefis Phyfica Nova*, dedicated by him in 1671 to the Society. He now fhewed them a new arithmetical inftrument, contrived, as he faid, by himfelf, to perform mechanically all the operations of arithmetic with certainty and expedition, and particularly, multiplication, after fuch a manner, that a whole feries of numbers, to be multiplied by other numbers, might be multiplied, if the multiplier be one number, by only one turn of the wheels of the machine; and if there be two numbers multiplicands, the operation fhall be difpatched by two turns, and the addition of the two products performed at the fame time, and fo on. And as for divifion, that might be performed by determining the quotient without dividing.

He gave fome proof of what he faid, but acknowledged the inftrument to be imperfect, which he promifed to get perfected, as foon as he fhould be returned to Paris, where he had appointed a workman for it, whom he would order to make alfo a complete one for the fervice of the Society, who returned him thanks for thefe expreffions of his refpect and generofity.

January 29. Mr. Boyle being made acquainted with the Society's defire, of knowing what liquor it was, which he had fent to the laft meeting, and which had hardened foft bread, faid, that it was fixt nitre refolved *per deliquium*.

He was thanked for this communication; as alfo for another, which was a method of producing a colour by two limpid liquors mingled together, and that without precipitation; and of deftroying the colour thus produced, without precipitation; of which he now fhewed the experiment with the defired fuccefs.

He intimated, that this experiment might conduce to the clearing of the doctrine of diaphanerty and opacity.

He took occafion to inform the Society, that he had lately feen a piece of an ofier-tree, which he had taken for a piece of whale-bone, both for blacknefs and bending: it was found in a little rocky uninhabited ifland near Barbadoes.

[1] Letter-book, vol. v. p. 422.

Mr. OLDENBURG read the following letters:

1. Of Dr. BEAL, inclosing one from Mr. BUCKLAND of Somersetshire, dated December 30, 1672, concerning a strange frost or freezing rain, which had lately destroyed abundance of orchards in the country about Bristol [m].

2. Of Monf. SLUSIUS, dated at Liege, 17th January, 167 2/3, N. S. containing his short and easy method of drawing tangents to all geometric curves, without the labour of calculation [n].

3. Of Dr. SWAMMERDAM, dated at Amsterdam, 24th January, 167 2/3 [o], acknowledging the receit of Mr. OLDENBURG's letter of thanks from the Society, for the Dr.'s late anatomical present, and communicating some new discoveries made by himself in anatomy, viz.

1. Of some animals, which have lungs, and yet naturally want a *vena arteriosa*. 2. Of the testicles of *scurabæus nasi-cornis*, that they exactly agree in their structure with those of a man, and do *ex unico, tantum funiculo longo, curvo, innumerabiliter flexo, atque (quod nondum*, says he, *in homine mihi visum est) in principio seu apice suo cæco, constare.*

Mr. OLDENBURG was ordered, 1. To desire Monf. SLUSIUS to impart likewise his demonstration of his method of tangents. 2. To desire Dr. SWAMMERDAM to acquaint the Society, what animals they be, wherein he had found the *vena arteriosa* wanting.

Mr. BOYLE mentioned, that in a man executed some years before, the *foramen ovale* had been found open.

It was remarked hereupon, that the anatomical examination of amphibious creatures might make some good discoveries; and that therefore the physicians of the Society would do a considerable service to anatomy, if they would examine such animals more carefully than had been hitherto done.

Mr. HOOKE mentioned, that the reflecting speculum, which he had produced at the last meeting, was farther published; and that he would endeavour to get it finished in a short time.

February 5. Mr. HOOKE produced again his objective speculum for the reflecting telescope, which he affirmed to be now true, though not perfectly polished; which he would procure to be done against the next meeting.

[m] It is entered in the Letter-book, vol. vi. p. 2. and published in the Philosoph. Transact. vol. vii. nº 90, for January, 167 2/3, p. 5138.

[n] Letter-book, vol. vi. p. 11. It is published in the Philosoph. Transact. vol. vii. nº 90. p. 5143.

[o] Letter-book, vol. vi. p. 25. Part of this letter is printed in the Philosoph. Transact. vol. viii. nº 94. p. 6041. for May, 1673.

He

He mentioned, that he intended to have an arithmetical engine made, which ſhould perform all the operations of arithmetic, with great expedition and certainty, without making uſe of the rhabdology, and that much more ſimply than that of Monſ. Leibnitz, produced before the Society on the 22d of January. He was encouraged to make good his propoſition.

Mr. Oldenburg produced a regiſter of obſervations, concerning winds and weather, left with him by Monſ. Leibnitz, by whom it had been brought from Paris, where the obſervations had been made with an inſtrument called Otto Guericke's *little man*; which is a tube kept in that city by Monſ. Dalancé, containing a matter, which was held a ſecret by the author, who pretended by it to prognoſticate the winds and their force ten or twelve hours before they blew; as alſo fair and rainy weather. It was added, that by this regiſter, marking the ſeveral ſtations of the liquor, the ſignification, and the event, it appeared, that for the moſt part the event had anſwered the prediction, though ſometimes it had failed.

This gave occaſion to ſpeak of the weather-cock ſo often mentioned formerly, and ſo deſirable and uſeful: and it was ordered, that Mr. Hooke do not fail to get ſuch a clock made as ſoon as poſſible; eſpecially ſince in France, Italy, and Germany, the curious were known to be ready to join their obſervations on the weather to thoſe made by the members of the Society. Mr. Hooke propoſed to take care of this immediately.

Occaſion being given to ſpeak of petrifications, it was remarked by Mr. Hooke, that he was credibly informed, that there was a ground in Bedfordſhire, which would in a twelvemonth's time turn wood and other matter, that was not ſtony, into ſtone, without vitiating the figure.

This was confirmed by Sir Robert Moray, who added, that the king had expreſſed his intention of buying that ground, and walling it about, on purpoſe to make in it experiments touching petrifaction.

It was wiſhed, that his majeſty, when there ſhould be a proper opportunity, might be put in mind thereof, to command it to be done.

Sir Robert Moray preſented a centre fiſh-petrified.

Mr. Oldenburg produced ſome yellow amber, and a piece of *lignum foſſile*, given him by Mr. Henshaw's clerk, Mr. Tribolet, lately arrived from Copenhagen, near which city it had been digged out of the ground, at the diſtance of three or four hundred paces from the ſea. Mr. Hooke declared his opinion, that yellow amber was nothing but reſin petrified.

It was ordered, that Mr. Hooke's objective ſpeculum ſhould be again produced and tried at the next meeting.

February 12. being Aſh-wedneſday, the Society did not meet.

February 19. There was preſented to the Society, from the Eaſt-India company, the whole ſkin of a muſk-deer; for which the thanks of the Society were returned by the meſſenger who brought it. And the vice-preſident, Sir Robert Moray, was deſired to expreſs, upon occaſion, to the governor of that company, Sir John Banks, the great ſenſe, which the Society had of their favour and kindneſs, in increaſing the ſtock of their philoſophical ſtore-houſe with ſo rare a preſent; which was delivered to Mr. Hooke for the repoſitory.

Mr. Oldenburg delivered likewiſe to Mr. Hooke Dr. Swammerdam's treatiſe, intitled, *Uteri muliebris Fabrica, una cum Methodo nova Cavitatis Corporis ita præparandi, ut ſuam ſemper genuinam faciem ſervent:* printed at London, 1672, in 4to, and preſented to the Society by the author.

Mr. Oldenburg preſented alſo to the Society, from Signor Francisco Redi, two books, the one printed at Florence, in 4to, intitled, *Eſperienze intorno alla Generatione degl' Inſetti, fatte da Franç. Redi*; the other more lately publiſhed under the title of *Eſperienze intorno a divorſe coſe naturali*, printed at Florence, 1671, in 4to. Thanks were ordered to be returned to the author, as alſo to Mr. Dodington, for his care in bringing theſe books with him out of Italy. The latter of them was delivered to Mr. Oldenburg, in order to make an extract of it, to be exhibited at the next meeting.

Mr. Boyle preſented a branch of a willow or oſier-tree, which he had made mention at the meeting of January 29, 1672, that it was found in a ſmall rocky uninhabited iſland near Barbadoes, and was like whalebone for blackneſs and bending.

Mr. Oldenburg produced and read a letter in Latin, left with him by Monſ. Leibnitz, dated at London, $\frac{12}{20}$th February, $167\frac{2}{3}$ [p], containing his deſire of being received into the Society, and his engagement of ſerving them to the utmoſt of his power, in promoting the deſign of their inſtitution.

This gentleman having been lately preſent at ſeveral meetings of the Society, and at one of them having produced and ſhewed an ingenious arithmetical engine, and in other reſpects given teſtimony of his abilities, and of his great eſteem for the Society, Sir Robert Moray having taken public notice hereof propoſed him as candidate.

Mr. Hooke tried again the experiment formerly attempted, of finding, whether air increaſes or decreaſes by burning: but it miſcarrying again, he was deſired to fit it better for the next meeting.

Mr. Reid of Herefordſhire having ſent ſome red-ſtreak grafts for the ſervice

[p] Letter-book, vol. vi. p. 34.

of

of the Society, it was ordered, that ſuch members, as had occaſion to propogate this cider-fruit, ſhould take their ſeveral proportion of theſe grafts.

There was produced a Bononian ſtone, which Mr. Dodington brought out of Italy and delivered to the ſecretary for the Society, and which was ſaid to have been duly prepared for ſhining.

It was ordered, that at the next meeting this ſtone ſhould be produced again, to make trial of its ſhining, there being now no ſun for ſuch a trial.

Mr. Oldenburg produced ſeveral copies of Monſ. Heckerus's printed admonition to aſtronomers, *De mercurii in ſolem incurſu:* which copies were, according to the author's deſire, diſtributed among the members of the Society.

February 26. The Society did not meet.

March 5. Edward Bernard B. D. profeſſor of Aſtronomy in the univerſity of Oxford, was propoſed candidate by Mr. Oldenburg.

Mr. Hooke made an attempt again of the trial to find, whether air is generated or conſumed by burning; but the apparatus failing again, he was ordered to fit it with care.

He produced his arithmetical engine, mentioned by him in the meeting of 5th February, and ſhewed the manner of its operation, which was applauded. He was deſired to bring in the deſcription of it, that ſo it might the better appear how it differed from that of Monſ. Leibnitz, produced January 22. before the Society.

Mr. Oldenburg gave an account of part of Signor Redi's book, intitled, *Experienze intorno a diverſe coſe naturali*; wherein occurred ſome particulars, thought not inconſiderable: as 1. Of waters diſtilled in a leaden bell, rendering all ſorts of natural waters turbid, when infuſed on them, except the conduit water of Piſa, which yet admits of a caution. 2. Of waters diſtilled in glaſs, ſometimes growing troubled when mingled with waters diſtilled in lead, ſometimes not. 3. Of cinnamon-water, which diſtilled in glaſs, and kept in glaſs, remains clear; but kept in cryſtal of Piſa grows turbid in a few hours, and milky, and in a few days yellow and bitter, though in cryſtal of Rome and Venice it does not become turbid till after two or three days; in cryſtal of Paris, not till after a much longer time. 4. Of the torpedo, ſtupifying only when touched and ſqueezed, not at a diſtance; together with a curious account of that fiſh diſſected.

Sir Robert Moray preſented a pear grown out of a pear, each having a ſtalk of its own.

5 Mr.

Mr. HOOKE promifed to give the Society, at their next meeting, a lecture upon his weather-clock.

March 12. Mr. HOOKE read a difcourfe of his upon the weather-clock; which being but a part of the whole intended by him, he promifed to bring in the remainder, containing the defcription of the engine, at the next meeting.

He was defired to take care, that fuch an engine be made with fpeed.

Mr. OLDENBURG produced two papers, one of which was from EZRAEL TONGUE, D. D. about a way of multiplying divers forts of trees, with fpeed, by tongue-grafting (as he calls it) their roots, and by covering the places fo grafted with earth, about two inches deep. The other was a letter from Mr. RICHARD REED, dated 27th February, 167$\frac{2}{3}$, at Lugwardene in Herefordfhire [q], concerning two queries about planting, 1. Whether, in planting, the roots are to be fet again at large, or pruned near to the trunk or body of the tree. 2. Whether early or late planting, both as to the living, and alfo the future thriving of the tree, be to be preferred; all benefits and inconveniencies of both feafons being confidered? Mr. REED declaring for planting with little root, and for planting in February and March rather than before winter, and giving reafons for both.

There was prefented an human fkull, altogether and very curioufly overgrown with very fine mofs, which was faid to have grown fince it was brought over, in a chamber of Monf. SCHROTER, who prefented it, having procured it in Germany.

There was read a Latin letter of Dr. JOHN BAPTISTA GORNIA, phyfician to the grand duke of Tufcany, dated at Florence, 3d January, 167$\frac{2}{3}$, and written to Sir THEODORE de VAUX, containing the writer's opinion concerning the difeafe, of which Dr. WILKINS bifhop of Chefter died.

Mr. OLDENBURG prefented the feventh volume of the *Philofophical Tranfactions.*

March 19. Mr. HOOKE read a difcourfe of his, giving an account of the fuccefs of this experiment, which, he faid, he had made, about the increafe or diminution of air by burning; which was, that the air was diminifhed one twentieth part.

He was defired to profecute thefe experiments, and to give the Society an account of them from time to time, and to befpeak fome members of the Society to affift at them.

He was put in mind to profecute the invention of the weather-clock, and to haften the making of it; and not to forget the finifhing of the reflecting fpeculum.

[q] Letter-book, vol. vi. p. 51.

Mr. Oldenburg read a letter to himself from Dr. Swammerdam, dated at Amsterdam 24th March, $167\frac{2}{3}$ [r], giving an account of and naming the animals, which have lungs, and yet want a *vena arteriosa*; as also a description of the structure of the genitals of a *scarabæus nasicornis*.

1673, *March* 26. Mr. Hooke made an experiment of mingling oil of vitriol and common water together, thereby shewing, that these two liquors were so incorporated, by entering into the pores of one another, that they took up less room, when mingled together, than they did both being apart. Of the common water there were twenty-one measures; of the oil of vitriol three measures, which is twenty-four measures in all, and yet mixt together they made but twenty-three measures.

Mr. Oldenburg read two letters, one to himself from Signor Cassini, dated at Paris 25th March, 1673, N. S. [s] presenting to the Society his observations of two new planets moving about Saturn, the one within the *satelles* of Monf. Huygens, and therefore by the discoverer called *intimus*, making its periodical revolution about four days and an half; the other without the Huygenian *satelles*, and therefore called *extimus*, finishing its course in about eighty days [t].

The other letter was from Mr. Gregory to Mr. Collins, dated at St. Andrew's, March 7, $167\frac{2}{3}$, about the effects of oblique reflection above those of the direct; as also concerning the charges and apertures of telescopes with convex or concave speculums, and of his notion concerning burning concaves, &c. This letter was as follows:

" I have received yours, dated February 20. together with Mr. Newton's answer, with which I am exceedingly satisfied. I am much engaged to you both, for the pains you have been at; I am almost convinced, that oblique reflection causeth more light than the direct; but I am not fully persuaded, that it is more regular. I conceive, that the rudely polished plate of metal, in an oblique position, causeth the image appear more different, because the obliquity hideth the concavities, so that no rays come to the eyes, but from the tops of the little tubercula, which are certainly best polished; the other rays, which confused the image, being kept away: but if the plate be exactly polished (I speak here as to sense) the position must be so oblique, before the insensible concavities can be hid, that the planes fall always even, to the sight, in a line. I grant, I have been mistaken in that first advantage, which I mentioned; for the plane speculum F, having certainly (as all human artifice hath) some errors in it, causeth greater prejudice by them, being remote from the focus, than being near to it, and in it there is none at all caused; where if it could be placed, and a near and direct aspect had of it, this were certainly the best telescope of this sort.

[r] Letter-book, vol. vi. p. 57. Part of this letter is printed in the Philosoph. Transact. vol. viii. for May, 1673. n° 94. p. 6041.

[s] Letter-book, vol. vi. p. 69.

[t] See Philosoph. Transact. vol. viii. n° 92. p. 5178. for March, 1673.

" It

"It is true indeed, that in telescopes with convex or concave speculums to double "the charge, the length must be almost doubled; but to double is a great altera-"tion, and hardly sufferable (as I suppose) in very good glasses, if the least charge "be considerable: but I understand not how the charge can be altered at all, with "the same glasses, in Mr. NEWTON's telescopes; for I know nothing of that, which "was described to Mr. OLDENBURG. It is true, that the eye-glasses can be changed "in all telescopes, if they be at hand of the required depth. I think, there is no "great hazard in these telescopes of overcharging, seeing the charge of the glass "can be diminished at pleasure; neither upon this account needs the angle of vision "be so small, seeing it is equal to the angle of the eye-glass from its focus, its other "focus being the little speculum; nor the darkness at all augmented, if the aper-"ture of the speculum be proportional to the diameters of the spheres.

"But above all things, I desire to know this, that seeing the image made by "the great speculum may be esteemed a small visible, and seeing Mr. NEWTON "in Transactions, p. 3080, thinketh it fitter to make a microscope or tube to "behold a small visible of one concave speculum and one eye-glass, rather than "with one single eye-glass, and much rather than with one plane speculum and "with one eye-glass: wherefore also to look to this small visible, the first also should "not be preferred to the last. This image indeed is not capable of such magnifica-"tion as a visible is; yet I am hardly sensible, how this should cast the balance, "taking in the defects of a plane speculum, together with other inconveniencies in "taking up this object. I said indeed, that hyperbolic and elliptic glasses were "tried in vain; but I spake not so of spheric speculums (as Mr. NEWTON's words "seem to imply, Transact. p. 4059;) for any thing I did, deserves not the name "of a trial, seeing Mr. REEVE and Mr. COCK both know, that the great specu-"lum was polished only with a cloth and putty; neither, the truth is, thought "it worth the pains, at that time, to be serious about further inquiry in that bu-"siness; for they undertook indeed to polish a less speculum to me upon the "tool. I am not yet fully convinced, which of these two ways have the best "advantage, albeit I incline more to Mr. NEWTON's, especially because of the "small distance betwixt the plane speculum, focus and the eye; however, ex-"perience must determine all; neither am I concerned how it happen. I had "no intention, that my thoughts of these telescopes should be printed: my design "was only before, as now, that, if you thought fit, otherwise not, you might send "them to Mr. NEWTON.

"I received those letters you mention, as also that box, together with the "things contained, and particularly Horrox's Posthuma, for which I must acknow-"ledge myself exceedingly engaged to you. I have perused him, and am satisfied "with him; it was a great loss, that he died so young.

"Mr. NEWTON's discourse of reflection puts me in mind of a notion I had of "burning-glasses several years ago, which appears to me more useful than sub-"tile: if there be a concave speculum of glass, the leaden convex surface having "the same center with the concave; or, to speak precisely, albeit perchance to little "more

" more purpose, let the radius of the concavity be c, the thickness of the glass in " axis transitum f, the radius of the convexity equal to $\frac{9c^2 + 18cf + 5f^2}{9c + 5f}$;) this " speculum shall have the foci of both the surfaces in the same point; and not only " that, but all the rays, which are reflected betwixt the two surfaces, shall in their " egress come quam maxime to the common focus. The making of such a speculum " requireth not much more art than ordinary plane glass, seeing great subtilty is not " necessary here; so that, I believe, they, who make the plane mirror glasses, would " make one of these three foot in diameter for four or five pounds sterling, or little " more; for I have seen plane glasses, almost of that bigness, sold even here for less " money. Now seeing (as Mr. NEWTON observeth) that all reflecting metals lose " more than one third of the rays, this concave glass, even *cæteris paribus*, would " have a great advantage of the metalline one; for certainly an exactly polished " thin mirror glass, of good transparent matter, after a few reflections, doth not " lose one fourth of the rays; and upon other accounts this hath incomparable " advantages; seeing it is more portable, free from tarnishing, and above all " hardly one twentieth part of the value.

" The great usefulness of burning concaves, this being so obvious, and yet (for " that I know) untouched by any, makes me jealous, that there may be in the " practice some fallacy. You may communicate this to intelligent persons, and " especially to Mr. NEWTON.

" P. S. If you please, let me hear with the first convenience, what may be " judged the result of this burning concave; for I am as much concerned to be " undeceived, if there be any insuperable difficulty, as to be informed of a most " surprising success. I have spoke of it to several here, but all were as ignorant " of it as myself. Several months by-past I have been so much busied in some " private studies, that I have forgot to pay my respects to you, which otherwise " my inclinations lead me to, upon which account I am more tedious now than " at other times. I desire yet to be more particular in the matter of telescopes; " I suppose a four foot telescope to have the aperture of six inches; the little con- " cave having the aperture of three fourths of an inch may magnify eight times, " the radius being one foot: in this case the hole in the middle of the great con- " cave is only three fourths of an inch, which being filled with an eye-glass, equal- " ly convex on both sides, amplifying the charge of the little concave twenty " four times, doth make a telescope magnify the object an hundred and ninety " two times, (which is no extraordinary charge, seeing Mr. NEWTON's table giv- " eth an hundred and seventy one and might be much less without inconvenience) " taking in an angle of vision of above twenty degrees, and with this there is " not lost one sixtieth part of the rays. With the loss of one thirty-sixth part of " the rays, it might magnify not above an hundred and forty four times and take " in an angle of vision of above twenty eight degrees. With all this the middle of " the object is illustrated with all the rays, which the aperture of the great concave " doth reflect. By these means, I think, that I keep off from those two incon- " veniences mentioned by Mr. NEWTON, in the seventh particular of his conside- " rations.

"rations. The event of these other considerations, as I suppose, can only be "determined exactly by experience."

It was ordered, that this letter should be communicated to Mr. NEWTON, as the person most concerned in it.

April 2. There was presented to the Society, from Mr. SAINT CROIX, his lately printed *Dialectica ad mentem* JOHANNIS SCOTI *eruta & elucidata*.

Mr. HOOKE made an experiment, by mixing oil of tartar and aquafortis together, to see how they would incorporate, and how much less space they would take up when thus incorporated than both apart. The mixture caused a great ebullition, which lasted all the while that the Society sat: but it ran over several times, and therefore Mr. HOOKE was desired to make it again.

Mr. OLDENBURG read a letter to himself from Mr. FLAMSTEAD, dated at Derby, 17th February, $167\frac{2}{3}$ [t], giving an account of his considerations upon Monf. HECKERUS's printed admonition, *De Mercurii in Solem Incursu observando anno* 1674, *mense Maio*.

It was ordered, that Monf. HECKERUS be made acquainted with the contents of this letter.

Mr. OLDENBURG read an account of some observations made by the prince of Conde, near Paris, about a well belonging to the house of the marquis of St. SIMON, of a moderate depth, and making an extraordinary noise, when the weather is to change from fair to foul, and the greater the noise, the worse the weather will be; but none at all, when the weather is changing from foul to fair.

It was remarked, that an inquiry should be made, whether the well was a dry one, or had water in it, and what was peculiar or remarkable in the situation of it, or ground about it.

April 9. Mr. EDWARD BARNARD and Monf. LEIBNITZ were unanimously elected into the Society.

Mr. HOOKE made an experiment with aquafortis and a little piece of brass wire, put into that liquor, marking where the liquor stood before the putting in of the brass, and where, after it was put in: as also, how far it was raised upon its working upon the brass, and how low it descended afterwards, which was almost an inch below the mark, at which it stood at the first putting in of the brass.

He promised to bring in a full account in writing of this experiment, and of that made at the preceding meeting.

[t] Letter-book, vol. vi. p. 41.

Mr.

Mr. Oldenburg read a letter to himſelf from Monſ. Huygens, dated at Paris, 14th January, 167$\frac{2}{3}$ [u], containing ſome conſiderations upon Mr. Newton's theory of light; together with Mr. Newton's anſwer to them, dated at Cambridge, 3d April, 1673 [x].

Mr. Oldenburg was deſired to communicate this anſwer to Monſ. Huygens.

He preſented to the Society from Mr. Boyle his new book intitled, *Tracts, containing new Experiments touching the Relation betwixt Flame and Air, and about Exploſions, &c.* printed at London, 1672, in 8vo.

Mr. Oldenburg gave notice, that Sir Joseph Williamson being to go to Aix la Chapelle, as one of his majeſty's ambaſſadors, offered his ſervice to the Society for inquiries after philoſophical matters in thoſe parts; and that himſelf, Mr. Oldenburg, had already drawn up ſome directions and queries for that purpoſe.

This offer was accepted, and it was ordered, that Sir Joseph Williamson ſhould be thanked, and the queries read; which being done, and ſome other particulars ſuggeſted by ſome of the members preſent, Mr. Oldenburg was deſired to digeſt and deliver them.

He read likewiſe a letter to himſelf from Dr. Beal dated at Yeovil in Somerſetſhire, April 1673, recommending a certain pear, making an excellent drink, though the fruit be of ſo very diſagreeable a taſte, that even hungry ſwine would not eat of it.

Dr. Beal was deſired to procure ſome grafts of it for Mr. Charles Howard, who would yet venture at this ſeaſon to ingraft them.

April 16. Mr. Hooke being called upon for an experiment, and having none ready, he was ordered to proſecute thoſe lately begun about the incorporation of liquors, and to bring in a written account of thoſe, that had been hitherto made.

Sir Robert Moray related an obſervation made of a liquor called *Goddard's drops*, exhaled in two years time to the half of it out of a glaſs hermetically ſealed, belonging to the lord archbiſhop of Canterbury.

This was confirmed by the lord biſhop of Saliſbury, who added, that it was ſo well ſealed up, that no ſmell at all could be perceived of the liquor within.

It was moved, that this glaſs might be deſired of the archbiſhop for making farther obſervations about it; and that, when obtained, it might be weighed, then

[u] Letter book, vol. vi. p. 17. Part of this letter is printed in the Philoſ. Tranſact. vol. viii. n° 96. p. 6086. for July 1673.

[x] Letter-book, vol. vi. p. 19. It is printed in the Philoſ. Tranſact. n° 97. p. 6108.

broken,

broken, and immediately after weighed again, to find whether any confiderable part of the liquor had been changed into vapours, and lodged in the empty part of the glafs.

Mr. HOOKE obferved, that fpiritous liquors, though well clofed up, would in time commonly lofe their virtue, and alfo their bulk, the particles of it paffing into the pores of one another.

The prefident moved, that fome of the fame drops might be very carefully fealed up, and then immediately weighed exactly, and after fome time weighed again.

Mr. OLDENBURG read a letter written to him by Dr. SWAMMERDAM, dated April 21, 1673, from Amfterdam [y], accompanied with fome anatomical obfervations of his about the pancreas and pancreatic juice of feveral fifhes; as alfo of an human *fœtus* lately found at Rome between the *ovarium* and the *tuba*, contained with its ufual integuments; the defcription and delineation whereof, he intimated, were then preparing at Rome.

April 23. An experiment was made with aquafortis and pulverifed oifter-fhells in a bolt-head, tied clofe about at the open end with a flaccid bladder, in order to fee, what it would produce; and it was found after a little while, that the bladder was fwelled. It was then ordered, that it fhould be put, as it was, into the trunk of the Society, and left there, locked up till the next meeting, to fee, whether thefe exhalations would prove permanent air.

Mr. BOYLE mentioned, that he had frequently made fuch kind of experiments, and thereby produced true air, which lafted for feveral months together.

Dr. CHAMBERLAYNE prefented a piece of bark, which he faid had been fent out of the Eaft Indies to the lord HERBERT [z], with this account, that it had been unfeen and unknown in that very place from whence it was fent, and that fome Indians had brought it thither, concealing the place where they had it. The fcent and tafte were very aromatical and pungent, efpecially thofe of the thin and innermoft barks.

Dr. CHAMBERLAYNE was defired to requeft the lord HERBERT, that fince he correfponded in the Eaft Indies, he would endeavour to procure a greater quantity of it, and, if poffible, an account of the place of its growth, it being very likely to be a very ftomachic fpice.

A letter of Mr. BERNARD, dated at Oxford, April 15, 1673 [a], returning to the Society his thanks for his election, was read.

[y] Letter-book, vol. vi. p. 91.

[z] CHARLES lord HERBERT, fon of HENRY marquis of Worcefter.

[a] Letter-book, vol. vi. p. 74.

There

There was produced a book belonging to Mr. HENSHAW, and sent by him to Mr. OLDENBURG, intitled, *Olaus Wormius de Mure Norvagico* [b], with the following relation prefixed to it in Mr. HENSHAW's own hand; "Memorandum, "quod d. 14 Junii, 1672, excellentissimus dominus ULDORRICUS FREDERICUS "GULDENLOW, filius naturalis regis Daniæ, FREDERICI III. defuncti, prorex "Norvagiæ, affirmavit mihi cum juramento, aliquando in Norvagia aliquos ex "istis muribus, quos incolæ *Lemming* vocant, super galerum suum depluisse; "quod ipsum & antea sibi accidisse ibidem mihi affirmaverat dominus CROUS, "Telenorius regis Daniæ in Norvagia."

It was thought by some of the members, that supposing the matter of fact to be true, those animals must have been carried by some very violent wind from an high ground into the air, and so fallen down; it having been observed from the relations in this book of WORMIUS, that as soon as such animals had fallen down, there had been found in their bellies herbs yet undigested and corn; which could not be but that they must have been before in such places, where such herbs and grains grow.

April 30. The Society did not meet.

May 7. CHARLES lord HERBERT, eldest son of HENRY lord marquis of Worcester, was proposed candidate by Mr. HOSKYNS.

There was produced the bladder, which at the meeting of April 23, had been somewhat inflated with air produced by aquafortis and powdered oister-shells, and now much more swelled than at that time.

It was moved, that it should be tried, whether this air thus produced would serve for burning; that is, whether a candle might be kept burning in it as in common air; and if so, whether for as long or a longer or shorter time: and that for this purpose this very air should be conveyed into another vessel, to burn bodies in it.

It was also ordered, that this experiment should be tried with a mixture of other bodies, to see whether air could be produced fit for respiration.

It was likewise moved, that it might be considered, whether the aquafortis be considerably wasted; or what quantity of it is raised up into air: for which end it would be necessary to weigh it exactly before it be put in; as also the oister-shells.

Mr. HOOKE remarked, that it would be worth trying, what effect precipitation would have upon air by pouring certain liquors upon solutions to make precipitations.

He read a paper of his concerning arithmetical instruments, as well those, that had been made upon the principle of the rhabdology, as that other shewn to the Society,

[b] Printed at Copenhagen, 1653, in 4to.

Society, January 22, by Monſ. LEIBNITZ; and he promiſed one of his own invention of better performance. This paper was ordered to be regiſtered [b], as follows:

"The beſt way for addition and ſubtraction is by ſetting down the numbers on "paper, and proceeding as in common arithmetic; both theſe operations being "quicker and much more certainly done than by any inſtrument whatſoever: "for, firſt, the numbers may be writ down in half the time they can be ſet on "any inſtrument; and, ſecondly, they remaining altogether in view, may be "quickly added or ſubtracted, and the ſum or remainder ſet down; and if there "ſhould be any miſtake in the firſt, they can be preſently run over again (which "is not a quarter part of the trouble of the operation) whereas by an inſtrument "to examine an operation over again, the whole trouble of the operation is per- "formed; and a man is much more ſubject to miſs in putting the key into the "right number, than he is in ſetting down the figure to expreſs it; and there- "fore, for thoſe kinds of operations in arithmetic, an inſtrument is wholly in- "ſignificant, and at beſt will come ſhort of common counters.

"Next, the beſt inſtrument for ſquaring and cubing, or for extracting the "ſquare or cubic root, is by printed tables for that purpoſe, ſuch as BABINGTON "hath printed at the end of his fireworks, or Dr. PELL hath lately epitomiſed and "reduced to a leſſer volume: for by the help of printing a book of tables, which "will preſently reſolve queſtions of that kind to twenty or thirty places, will be "reduced into a leſs volume, and be purchaſed at a much cheaper rate than any "arithmetic inſtrument, that ſhall do the whole operation itſelf without ſkill: "and, if ſkill in arithmetic be allowed to be joined in the uſe of the inſtrument, "printing will furniſh us with tables, that will do all thoſe kind of operations with "much more certainty and ſpeed, than any arithmetical inſtrument yet known.

"Thirdly, as to multiplication and diviſion, the lord NEPER, in his Rhabdo- "logy, hath taught a very excellent facilitating method, by the help of ſmall rods, "which I take to be the plaineſt, ſhorteſt, and exacteſt method of uſing that help, "much better than that of Monſ. PETIT, of putting them on a cylinder, or any "other way of putting them on moveable wheels; that way taking up much leſs "room, being more eaſily changed and varied, and being capable of the advan- "tage of the preſs, which makes them much leſs chargeable and cumberſome, "for they may be printed on parchment, and cut into ſtrips, which may be "afforded very cheap, will take up very little room, and they may be made "uſe of to what number of places one will.

"Or, if one will avoid ſetting down the intermediate products, his com- "pound rhabdology may be made uſe of, by printing thoſe roads, or places, "on parchment, both for the figures and holes, by the help of which there is "no uſe of addition or ſetting down till laſt of all, or that the whole operation "be compleated.

[b] Regiſter, vol. iv. p. 197.

"As

" As for the arithmetical instrument, the model of which was produced here " before this Society, it seemed to me so complicated with wheels, pinnions, can- " trights, springs, screws, stops, and truckles, that I could not perceive it ever " to be of any great use, especially common use: first, because the multitude " of the parts must vastly augment the charge and bulk thereof; so that it could " only be fit for great persons to purchase, and for great force to remove and " manage, and for great wits to understand and comprehend: secondly, because " the multitude of its parts must make it exceeding hard to be put into good " order, and extraordinary apt to be put out of it; besides, I saw no means of " examining, whether the operation had been truly performed, without trying " it over again, which is intolerable. The design, indeed, is very good, which " is the only thing I was able to understand of it, which is to give the product " and quotient of a multiplication or division, which Sir SAMUEL MORLAND's " Instrument is not at all adapted to. But I have an instrument now making, " which will perform the same effects with the German, which will not have a " tenth part of the number of parts, and not take up a twentieth part of the room, " that shall perform all the operations with the greatest ease and certainty imagi- " nable; whereby in large numbers, for multiplication or division, one man may " be able to do more than twenty by the common way of working arithmetic, " and, that without at all troubling his memory or ratiocination, and this by two " instruments quite differing in their principle and contrivances; the description " of which I design to present to this honourable Society, after the model pro- " mised by Monf. LEIBNITZ to be sent from Paris to this Society to be here seen " and examined."

Dr. GREW produced several roots of plants, as avens, primrose, orchis, &c. to shew, that part of the trunk of those roots descends so, as that, which is root now, will rot off, and the superior part next to it will supply its place: whence he concluded, that there was a double motion made in the trunk of the root; the one for receiving the juice for nourishment: the other for shooting downwards.

This seeming to some members to be a kind of muscular motion, it was moved, that the structure of the root should be well examined.

Signor BOCCONE, a Sicilian gentleman, who was well skilled in plants and petrifications, being present at this meeting, produced a certain leafy stone, called by him, *lapis fossilis, bitumen redolens, in montibus Hyblæis Siciliæ repertus*; as also a kind of *lapis bezoar mineralis*, found likewise in the same island, and there used in powder against fevers with good success.

Sir ROBERT MORAY related from captain HERBERT, that about the islands of Majorca and Minorca they had found within a rock shell-fishes, good to eat, of the taste of muscles; and that he had taken abundance of them.

Farther, that in those parts he had seen lying on the surface of the sea a substance with motion, which being touched by him had retired within the water; but

but a little after appeared again above water. Whereupon his curiofity had moved him to approach nearer to it, and to take it up out of the fea; which done, he had found it to be a kind of a living worm putting itfelf out and in, faftened in a fubftance like a plant as in a fheath.

Mr. OLDENBURG produced a book of Dr. de GRAAF, dedicated to the Society, intitled, *Regneri de Graaf Partium Genitalium Defenfio*, together with a letter to Mr. OLDENBURG, dated at Delft in Holland, 28th April, 1673 [c], communicating fome microfcopical obfervations of Monf. LEEWENHOECK [d]. The book was ordered to be examined by Dr. WALTER NEEDHAM, Dr. CROUNE, and Dr. KING, who were defired to give the Society an account of it.

Mr. OLDENBURG read a letter to himfelf from Mr. FLAMSTEAD, dated at Derby, 19th April, 1673, accompanied with a paper in Latin, containing fome obfervations of his own about Jupiter's tranfit near fome fixed ftars [e], ufeful for the determining its inclination to the ecliptic. Thefe obfervations were recommended to the perufal of Mr. HOOKE.

Mr. HOOKE defired, that Sir SAMUEL MORLAND's book, intitled, *the Defcription and Ufe of two arithmetic Inftruments*, &c. printed at London, 1673, 12mo. might be purchafed for the Society's library; which was ordered to be done.

May 14. Mr. BOYLE produced a liquor of his own preparing, which, though cold, and made feven or eight months before, yet in a minute gave a yellowifh tincture to a filver fixpence at firft, which afterwards turned to a blackifh colour: which experiment was feveral times repeated with the like fuccefs.

He being afked, what other metals it had this effect upon, faid, that upon brafs it did very well; not fo well upon fteel, much lefs upon tin.

Dr. WALTER NEEDHAM being called upon to make a report concerning Dr. de GRAAF's book dedicated to the Society, and referred at the laft meeting to his confideration jointly with Dr. CROUNE and Dr. KING, faid, that he had looked it over, but not yet communicated it to the other phyficians; and that he had found in general, that in this book there was firft a difpute between the author and Dr. SWAMMERDAM about the priority of the difcovery of the *ovarium & ova* in viviparous animals, and then a charge againft Dr. SWAMMERDAM of feveral errors in anatomy committed by him: that he, Dr. NEEDHAM, having compared this book with that of Dr. SWAMMERDAM, dedicated likewife to the Society, was of opinion, that, as to the difpute about the faid difcovery of eggs in viviparous animals, the readers muft be referred to the times, when the feveral claimants of that difcovery publifhed their books about it, and thence left to judge of the

[c] Letter book. vol. vi. p. 98.

[d] Printed in the Philof. Tranfact. vol. viii. n° 94. p. 6037. for May 1673.

[e] Letter-book, vol. vi. p. 84. The letter and obfervations are printed in the Philof. Tranfact. vol. viii. n° 94. p. 6033.

priority contended for. But as to the errors, which theſe two authors charged upon each other, he was of opinion, that in ſome things Dr. de GRAAF was in the right, and miſtaken in others, and *vice verſa* Dr. SWAMMERDAM; and that it would require ſome time to examine the particulars, in the doing of which it would be requiſite to make ſome obſervations to pronounce with the more certainty of theſe matters conteſted.

Dr. NEEDHAM received the thanks of the Society, and was deſired to proceed to that particular examination, and to adviſe with the other two phyſicians in it, according to the order of the preceding meeting; which he promiſed to do.

Mr. HOOKE made an experiment with the air, produced 23d April, in a bladder by the operation of aquafortis upon oiſter-ſhells, having firſt tried how long a ſlender white wax candle would burn with common air, which it did, in one glaſs, during the ſpace of ſometimes ſeventeen, ſometimes twenty or twenty-one vibrations of a pendulum of about a ſecond; in another bigger glaſs, during the ſpace of 55 vibrations: whereas the factitious air, being by a certain contrivance ſqueezed out into the larger glaſs, yet ſo that ſome of the common air remained in it, the ſaid wax-candle burnt in it only forty-five ſuch vibrations.

This experiment being not accurate enough, Mr. HOOKE was deſired to make another apparatus for a better trial.

It was moved again, that ſome experiments might be made to produce air fit for reſpiration; upon which occaſion Mr. BOYLE ſuggeſted, that the trial might be made with coral and vinegar.

May 21. There were viewed ſeveral curioſities concerning corals and ſtones belonging to Signor BOCCONE; and it was ordered, that he ſhould be thanked in the name of the Society for his reſpect and communications to them.

Three letters were read, one from Signor MALPIGHI to Mr. OLDENBURG, dated at Bologna, 10th May, 1673[f], ſignifying the continuance of his obſervations relating to the anatomy of plants; as alſo of his having ſeen ſtatutes and pictures ſhining in the dark with flaming blue and white colours.

The other two letters were from Monſ. LEIBNITZ to Mr. OLDENBURG, dated at Paris, the former April $\frac{16}{26}$[g], the other May $\frac{14}{24}$[h]; both containing philoſophical communications, and notice of his arithmetical engine being very near perfected.

May 28. The experiment of generating air with aquafortis and oiſter-ſhells powdered was made again; which being done, and a wax candle having burnt or the common air of a glaſs veſſel, ſometimes thirty-ſeven, ſometimes forty or forty-five vibrations of a pendulum of about three feet long, the ſame candle

[f] Letter-book, vol. vi. p. 114. [g] Ibid. p. 101. [h] Ibid. p. 115.

put in the vessel filled with the factitious air would not burn in it, but only an inch beneath the mouth of the glass, where the outward common air had some communication with the produced air; for, being put lower, it went out immediately upon several trials. It was observed, that the candle being gone out near the orifice, it would catch the flame again, when hastily drawn up close to the top. Besides, it was taken notice of, that when this factitious air was driven out of the vessel, the flaming candle held over it was presently blown out by it.

Mr. John Templer, an ingenious gentleman, come out of the country, and upon his desire admitted to be present at this meeting, produced a very fine bed of amethysts brought from the East Indies, wherein some stones of that kind were very regularly shaped, and well tinged; others yet untinged, which were supposed to have not yet been pervaded by the tinging juice.

Mr. Hoskyns produced a piece of silver ore, lent him by captain Bertue, who had brought it out of Sweden, where, he said, in the Swedish Silverberg, as he had been informed, they throw in coal over night into the rocky mine, and having let it burn and calcine all night, slake it the next day; whereupon the stony part being washed out of the ore by the water, the metal appears, as in this piece, in long, thick, silvery streaks.

Mr. Oldenburg read a letter written to him by Mr. Lister from York, 21st May, 1673 [1], containing divers considerable particulars about very aged persons; sudden appearances of vast troops of insects; a strange quantity of divers sorts of worms found in the guts of dogs, and in the ulcerated ancle of a girl; the analogy betwixt the veins in plants and the nerves in animals: the actual passage of the chyle into the lacteal vessels; together with the experiments made by him upon that subject; the result of which was, that, notwithstanding all the injections made by him with tinged liquors into the guts of live animals, he could never find the least discolouring of the chyle on the other side of the guts, that is, within the lacteal veins; but always white and uniform.

It was ordered, that Mr. Lister should be desired to continue such instructive experiments.

June 4. The lord Herbert was elected into the Society.

Mr. Hooke made an experiment with air produced out of bottled ale, putting it into a glass vessel, in order to see, whether, and how long, a candle would burn in it; and it was found, that it would no more burn in this air, than it did in air generated out of aquafortis and pounded oister-shells.

It was proposed, that something might be thought upon for correcting this air, so as to make a candle burn or animals live in it.

[1] Letter book, vol. vi. p. 124. Part of it is printed in the Philosoph. Transact. vol. viii. n° 95. p. 6060. for June 1673.

Mr.

Mr. HOOKE said, that he would consider of it, and try, whether it might be corrected by precipitation.

Sir ROBERT MORAY produced a paper, which was read, containing an account of some experiments made by Dr. WALTER NEEDHAM, and Mr. RICHARD WISEMAN, serjeant chirurgeon, with the liquor sent out of France, where it was famous for stanching of blood in a little time, without any eschar, suppuration, or cicatrice [k]. It proved successful, though, in these trials, not in so short a time, as the Parisians said they had found it.

Sir ROBERT MORAY mentioned, that Sir SAMUEL MORLAND, bart. had given out, that he had invented a kind of a force-pump, which should perform better than other pumps hitherto used; that it should have no rubbing, but all impediments removed, and the whole strength applied: and, that the king had referred it to the consideration of the commissioners of the navy, in order to make use of this way in ships.

He related also, that Sir SAMUEL MORLAND had proposed a method of weighing anchors with ease and safety. Whereupon Mr. HOOKE affirmed, that he had several years ago invented a convenient method of doing the same thing; which having discoursed of somewhat in general, he was desired to acquaint the Society with the particulars at another meeting.

Dr. GREW shewed the company two microscopical observations upon a piece of fir, and another on oak-wood, a description of which he promised to communicate in writing.

June 11. Dr. GREW shewed three microscopical observations; the first, upon a piece of a wild olive-wood transversely cut, in which the air-vessels were seen to go round about the inner edge of the bark in a circle: the second, upon a piece of vine, cut likewise transversely; wherein the air-vessels appeared to lie in a strait line between the bark and the pith, and larger and more numerous than in olive-wood: the third, upon a piece of fir-tree, cut length-wise, wherein the sap-vessels were observed to be so many tubes made up of divers fibres as clusters, and those stitched together with other fibres running horizontally.

Dr. GREW was desired to give an account of those observations in writing, and to prosecute them.

Mr. BOYLE proposed the observing, 1. What difference there is between the structure of fruit-bearing plants, and those that bear no fruit? 2. Whether there be any difference in the air-vessels of the same plant in winter and in summer? 3. Whether the vessels below and above in a plant differ considerably in bigness; and in what part of the plant they are biggest? 4. Whether in the root the vessels be considerably bigger than in the body of the tree? 5. Whether the

[k] This account is printed in the Philos. Transact. vol. viii. n° 95. p. 6052. for June 1673.

parts of a graft after ingrafting do retain the same pores and figures of the air-vessels and sap-vessels, which they had before ingrafting, or upon the original tree: for instance, when an apricot is ingrafted upon a palm-tree, wherein, and in all other ingraftings, the sap, which passed through one sort of strainer, viz. that of the stock, passes now in the graft through another sort of strainer? 6. Since some grafts agree well with some stocks, and not with others, what difference there is in the several pores and vessels of such disagreeing plants? 7. The texture of all sorts of resinous trees.

Dr. GREW mentioned, that in resinous trees the air-vessels are very small and few, and the sap-vessels large, as in fir, cypress, &c. whereas in other trees, as in oak, the air-vessels are very large, and the sap vessels strait.

Mr. OLDENBURG read a Latin letter to the Society from Monf. LEIBNITZ, dated at Paris, 1st June, 1673 [l], giving them thanks for his election into their body.

Dr. WALTER NEEDHAM made an experiment of the French liquor for stanching of blood, upon a dog [m]. He cut the crural artery quite cross with an incision-knife: the blood gushing out copiously, a lint dipped in the liquor, of which there was but a very small quantity, was applied to the wound, and held upon it a little while, when, by reason of the great glut of blood, that could not be well wiped away for want of a spunge, the lint was changed for a fresh one dipped in the remaining liquor, and kept on about half an hour, and being then let loose, the blood was found stanched: whereupon the dog being unbound, licked the wound, and walked away without any ligature, being committed to the care of Mr. HOOKE, to see, whether the wound would keep stanch.

June 13. Dr. BISTER, a physician of Hamburgh, was proposed candidate by Mr. BOYLE.

Mr. BOYLE caused an experiment to be made with a liquor, which, though cold to sense, did, by its emitted fumes, in a minute, first through double, and then through four-fold paper, tinge a copper half-penny without tinging the paper interposed.

Monf. DENIS, a French physician, tried his blood-stanching liquor upon a dog [n], whose crural artery was opened by making a wide oblique orifice in it; to which his liquor being applied and held to it by a compress, the blood was stanched in seven minutes, and the dog was let go in five and twenty minutes, without any ligature, the compress being fallen off.

The Society thought fit to intermit their meetings from this day till the president should summon them to meet again.

[l] Letter-book, vol. vi. p. 137.

[m] An account of this experiment is printed in the Philosoph. Transact. vol. viii. n° 95. p. 6053.

[n] An account of this experiment is printed in the Philosoph. Transact. n° 95. p. 6053.

stanched

October 9. At a meeting of the council were present,

The President,

The lord viscount STAFFORD,	Mr. COLWALL,
Mr. CHARLES HOWARD,	Dr. CROUNE,
Sir PAUL NEILE,	Mr. HILL,
Sir JOHN LOWTHER,	Mr. OLDENBURG,
Mr. PEPYS,	

The president gave the council notice, that there had been lately with him a committee of the professors of Gresham College, and another of the Mercers company, inviting the Royal Society to return to that college, and to keep their assemblies there, as formerly they did before the fire. To whom he had returned his thanks for this kind offer, and for their respect to the Royal Society; adding, that he would acquaint the council with it at their next meeting.

This being reported, the council thought good to have their hearty thanks returned to the said committee for their kindness and respect, yet without saying any thing to them of acceptance or not acceptance; only, in case they should give occasion for saying more, that then it might be mentioned, that the business was under consideration.

The persons appointed to give these thanks were the lord viscount STAFFORD, Sir PAUL NEILE, Sir JOHN LOWTHER, Mr. PEPYS, Mr. COLWALL, Dr. CROUNE, and Mr. OLDENBURG, or any three of them.

Whilst this was doing, Sir THEODORE de VAUX came in, being sent by the earl of Norwich, earl marshal, to acquaint the council, that his lordship wondered, that they were not met in Arundel-house, as formerly, but yet hoped, that they would hereafter still continue their meetings there, as formerly; and that if they should remove to any other place, he could not but take it very unkindly.

Hereupon the president declared, that for this time he had caused the council to be summoned in this place for his particular convenience, his present occasions not having permitted him to go far off. And his lordship, at the desire of the council, returned their hearty thanks to the earl marshal for his singular affection and respect to the Society.

This being done, the president intimated, that it was time to call upon Dr. TILLOTSON, dean of Canterbury, as executor of Dr. WILKINS, bishop of Chester, for his legacy of four hundred pounds sterling, bequeathed to the Royal Society: Whereupon it was thought good by the council, that Mr. COLWALL and Mr. HILL should be desired to speak with the said dean about this matter at their first conveniency.

Chelsea college being spoken of, and something mentioned of pulling down the house, and selling the materials, it was thought fit by the council, that Mr. HOSKYNS

HOSKYNS or some other lawyer should be consulted with, whether, notwithstanding the clause in the charter of non-alienation, the said house might be pulled down, and the materials sold.

Mr. OLDENBURG produced the report of the three physicians, Dr. CROUNE, Dr. NEEDHAM, and Dr. KING, concerning the anatomical controversies between Dr. SWAMMERDAM and Dr. de GRAAF, referred to the judgment of the Society; and he desired to know, whether the said report should be transmitted immediately to the persons concerned, or deferred till the Society should meet again.

It was thought proper to send it away by the first post, considering that it had been long deferred already.

N° 97 of the Philosophical Transactions was licenced by the council.

October 22. At a meeting of the council were present

The president,
The Earl Marshal;
The lord viscount STAFFORD,
The lord bishop of Salisbury,
Mr. CHARLES HOWARD,
Sir JOHN LOWTHER,
Mr. PEPYS,
Mr. COLWALL,
Mr. HILL,
Mr. HOSKYNS,
Dr. CROUNE,
Mr. OLDENBURG.

The council considering the necessity of securing the weekly payments for carrying on the work of the Society, and having consulted the treasurer's book concerning the persons, that may be looked upon as good paymasters, they were found to be these:

1 The lord viscount BROUNCKER, president,
2 The Earl Marshal,
3 The earl of Anglesey,
4 The earl of Devonshire,
5 The earl of Aylesbury,
6 The lord viscount STAFFORD,
7 The lord bishop of Salisbury,
8 The lord bishop of Chester *,
9 The lord BERKLEY,
10 The lord BRERETON,
11 The lord HOWARD of Castle-rising,
12 Mr. BOYLE,
13 Mr. AERSKINE,
14 Dr. ARDERNE,
15 Mr. ASHMOLE,
16 Sir JOHN BANKS,
17 Mr. BARRINGTON,
18 Mr. BROOKE,
19 Dr. BROWN,
20 Dr. COTTON,
21 Mr. COLWALL,
22 Dr. CHAMBERLAYNE.
23 Mr. CREED,
24 Mr. EVELYN,
25 Dr. GLISSON,
26 Dr. GODDARD,
27 Mr. HAAK,
28 Mr. HOOKE,
29 Mr. HILL,
30 Dr. HOLDER,

* JOHN PEARSON, D. D.

31 Mr.

31 Mr. Hoskyns,
32 Mr. Charles Howard,
33 Mr. Edward Howard,
34 Mr. Thomas Howard,
35 Mr. Henshaw,
36 Mr. Le Hunt,
37 Dr. King,
38 Mr. Locke,
39 Sir John Lowther,
40 Mr. Lister,
41 Sir Paul Neile,
42 Dr. Walter Needham,
43 Mr. Oldenburg,
44 Mr. Parker,
45 Mr. Pepys,
46 Sir William Petty,
47 Mr. Smith,
48 Sir Robert Southwell,
49 Dr. Tillotson,
50 Sir Theodore de Vaux,
51 Dr. Wallis,
52 Dr. Ward,
53 Sir John Williams,
54 Sir Joseph Williamson,
55 Dr. Christopher Wren,
56 Sir Cyril Wyche,
57 Mr. Wylde.

This number being selected, there were some others found, whom the council thought fit to have asked, whether they were willing to comply with the new regulation of the Society, by paying their arrears, and by assuring their payments for the future: and they were these;

Sir George Ent,
Dr. Thomas Cox,
Dr. Whistler,
Dr. Thruston,
Mr. Newburgh, } To be asked by Dr. Croune.

Earl of Dorset,
Earl of Yarmouth, } To be asked by the Earl Marshal.

Mr. Ricaut,
Mr. Povey,
Sir James Long,
Dr. James du Moulin, } To be asked by the lord viscount Stafford.

Mr. Thomas Neile, To be asked by Mr. Hoskins.

Dr. Willis,
Mr. Slingsby,
Sir Nicholas Steward,
Sir James Shaen,
Lord viscount Ranelagh,
Lord Clifford, } To be asked by Mr. Oldenburg.

The Earl Marshal proposed, that the absent in remote places might be considered.

The president suggested, that it was necessary to secure first of all the anniversary elections, at which there must be present thirty-one fellows; and therefore such a number of fellows to be fixed, as might be likely to afford such a number of electors.

October

October 30. At a meeting of the council were present

The lord bishop of Salisbury in the chair,

The Earl Marshal,
Mr. Charles Howard,
Mr. Colwall,
Dr. Goddard,
Mr. Hill,
Mr. Hoskyns,
Mr. Oldenburg.

The Earl Marshal reported, that the earl of Yarmouth had declared to him, that he would clear his arrears to the Society: and for Mr. Povey, he had desired, that his account with the Society, for whose service in the business of the Savoy he had expended twenty pounds, might be stated; and that being done, he was willing to pay what should be due from him above that sum.

Hereupon Mr. Oldenburg was ordered to search in the Council-book what was formerly ordered by the council in this matter.

Concerning Mr. Ricaut, the Earl Marshal offered to write to him to Smyrna about his arrears; and doubted not but they would be satisfied.

Upon this occasion of Mr. Ricaut's absence in remote parts, the Earl Marshal proposed, that such members of the Royal Society, as were abroad, or should go abroad, and continue absent from England above three months, should not be obliged to pay their weekly contribution after those three months were expired; but every such fellow should be left at his own liberty to pay or not after that time, till he should be returned to England.

This proposition was unanimously agreed to by the council.

It was also ordered, that the fellows, who were in arrears, should be allowed, if they made no present payment of them, to give a bond to the Society, to pay within, or at the end of, six months; and that Mr. Hoskyns draw up a form for such a bond.

Memorandum. That when the number of the fellows, who were, or were to be, shall be agreed upon, the form of a legal tie be presented to every one of them to secure the weekly contributions.

It was mentioned, that as long as it was not known, how many would remain of those, who were now of the Society, the number of the ordinary fellows could not be fixed.

The Society this day resumed their weekly meetings.

Sir Justinian Isham, Bart. was proposed candidate by Dr. Walter Needham.

Mr. Hooke being called upon for experiments, and particularly concerning the weather-

weather-clock, said, that he would prepare some experiments for the next week, and take care of having the weather-clock made; as also of finishing his discourse upon it.

Dr. WALTER NEEDHAM presented for the repository a jaw-bone of a lamb, sent him by Mr. TEMPLER out of Northamptonshire, which had all its teeth discoloured with a brazen colour.

Mr. CHARLES HOWARD produced such another, which, he said, was brought out of Sicily, where it had been affirmed to him, that generally the sheep, which feed upon a certain mountain there, had teeth thus coloured.

Some of the members were of opinion, that this colour might proceed from herbs growing in such ground, as had underneath it copperas mines; others thought that it might be artificial.

Mr. OLDENBURG presented from Dr. HOBOKEN, a Dutch physician, his book, *De Anatomia secundinæ humanæ repetita & aucta*, printed at Utrecht in 1672; together with a letter from the author to Mr. OLDENBURG, dated 8th August, 1672, this letter and the book having been detained long in their way to England on account of the war.

Mr. OLDENBURG read likewise several other letters and papers, which came to his hands during the Society's recess, as

1. A paper in Latin, sent by Mr. HENSHAW from Copenhagen, in a letter, dated August 7, 1673 [p], which paper contains the answers of one LUCUS JACOBI DEBES chief minister in the isles of Fero, to divers queries formerly proposed to him [q].

The paper was as follows:

" Ad primas duodecim quæstiones, nihil in promptu est, ex Fœrøis, quod re-
" spondeatur: quoniam iis in terris aut nunquam aut raro intensum aliquod est
" frigus.

" R. 13. Fulgura & tonitrua accidunt ibi semper hyberno, nunquam æsti-
" vo tempore: circa halones & irides nihil singulare adhuc observavi. Ignes fa-
" tui nunquam ibi apparent.

" 14. Frequentiores venti sunt Africus & Zephyrus, inprimis vere & autum-
" no. Afferunt plerumque tempestatem pluviosam: hæc autem ventorum effecta
" sunt observata, quod sæpius ei plagæ, a qua flat ventus, aërem afferant nu-
" bilosum; adversæ autem serenum; id quod fieri existimem propter excelsos in-
" sularum montes, aeris liberum motum impedientes.

[p] Letter-book, vol. vi. p. 228. [q] Ibid. p. 229.

" 16. Refractionem, nec non diametrum solis & lunæ, ortus vel occasus " tempore, curioso non licuit observare, propter obstantia montium juga. Pleia- " des omnes, quamvis obscuræ, conspiciuntur tamen cœlo sereno. Luna ple- " rumque apparet tertio, interdum quarto, die a novilunio.

" 17. Eclipses vix ibi possunt observari, propter aerem turbulentum, ea in " plaga frequentissimum.

" 18. De salis copia vix possum certo quid statuere; ego semel, necessitate " adductus, ex viginti quatuor * * aquarum marinarum dimidiam salis co- " quendo mihi comparavi: mare tamen valde salsum esse indicio sunt multi ma- " nipuli salium, qui colliguntur in scopulis & rupibus, ubi æstas incidit calida " & serena. Lucet quidem & micat mare noctu, sed non, nisi turbatur remis inter " remigandum. Si de currentibus cæterisque maris affectibus eo spectantibus " referrem, volumen conscriberem: quia vero de omnibus & singulis in libro meo, " jam in lumen prodeunte, (qui Fœroæ, vel Fœroa reserata inscribitur) fusius " egi, ad eum curiosos remitto.

" 19. Ex mineralibus saltem invenitur talcum, perexiguæ tamen quantita- " tis; ex cæteris nihil.

" 20. Magnetis variatio est 13 gr. 19 min. occidentem versus, uti observatum " est anno 1659, die 25 Decembris.

" 21. Ferrum opinione citius contrahit ferruginem, a qua ita arroditur, ut " tenue ferrum intra paucos annos non sit usibus humanis.

" 22. Nullæ feræ in Foerois habentur, sed domestica tantum animalia: quæ- " nam circa ea, nec non aves & pisces, sunt notanda, copiose in mea Færoa " reserata explicavi.

" 23. Inter vegetabilia, hæc occurrunt notabilia; radix Rhodia, quæ alibi " studio in hortis colitur, ibi ubertim sponte naturæ provenit, crescens super am- " nibus & mari, in præruptis montibus & promontoriis, qua ancillæ utuntur ad " capillos flavo colore tingendos: nec minor vis angelicarum nascitur in monti- " bus, cœmiteriis, & hortis, quas incolæ non tantum in deliciis habent, sed cau- " libus earum radicibusque coctis famem propulsant, incidente annonæ caritate. " Tormentillarum incredibilis habetur copia, quarum radicibus, loco corticum, " utuntur ad coria præparanda. Varia antiscorbutica ibi etiam inveniuntur; de " cæteris nihil relatu dignum. De viribus herbarum inhabitatores parum sunt " solliciti; olera varia ibi crescunt, quorum semina ex Dania afferuntur, quippe " raro ad tantam maturitatem perveniunt, ut semina ferant, præter brassicam; " cujus semen tandem degenerat in rapas. Ex frumentis tantum seri potest hor- " deum; arbores nullæ crescunt præter juniperum super terram serpentem.

" 24. Equi & oves brumali tempore semper sub dio vitam tolerant, quo- " niam tam hyeme quam æstate aer est temperatus.

" 25. Vac-

" 25. Vaccæ & equi sunt concolores cum aliis ejus generis in aliis regionibus : " ovium aliæ sunt albæ, aliæ nigræ, aliæ rubræ, sed pro loci diversitate ; in bo- " realibus insulis pleræque albæ, in australibus autem nigræ : ubi vero oves albæ " e borealibus insulis transferuntur in australes, pedetentim nigrescunt; quo co- " lore inficiuntur primum circa pedes, dein circum femora, post sub ventre, de- " nique super dorso : utrum hæc nigredo proveniat ex terræ nitro an sulphure, " curiositatis magistrorum censuræ atque judicio submittitur.

" 26. Pestis & febris Foerois exulant ; interim afflictantur nonnulli lepra, " multi scorbuto, omnes catharro quotannis, vere ineunte. Ad scorbutum pel- " lendum, utuntur aut lacte solo recenti, aut cum cochleariis cocto. Ex catarrho " ita laborant, ut nonnulli sint morti vicini, morteque pauci interdum defun- " gantur ; adversum quem morbum serum lactis vetustum, fere fervidum, bi- " bunt, idque feliciffime. Alias conflictantur cum morbo quodam peculiari, quem " vocant Landfarfoot, febri militum castrensi non absimili ; cui nullum adhibent " remedium, sed eventum Deo committunt, quo etiam medico plerique conva- " lescunt.

" 27. Plumulæ anatinæ, quas *Eiderdun* vocant, colliguntur ex certa quadam " ave marina, *Eider* nominata, quæ plumas illas ex proprio suo pectore, inter ex- " cludendos pullos, pro ovis fovendis evulsas in nido reliquit ; unde excerptæ " colliguntur ; quæ autem plumæ alio tempore vi evelluntur, propter pinguedinem " nulli sunt usui.

" 28. Monocerotes marini juxta littora Fœroarum nunquam visi sunt ; va- " ria alioquin genera Cetorum mare Foeroanum frequentant, quos inter certi ge- " neris Cetus incolis est maxime molestus, quem nuncupant Troldhual, ad quem " repellendum, aut castoreum, in carina cymbæ inclusum, servant, aut lignum " juniperinum in mare projiciunt, quorum, vel istius fœtorem vel hujus odo- " rem olfaciens ad imum subsidet."

2. A letter from Mr. Hevelius to Mr. Oldenburg, dated August 23, 1673[1], together with the title page of his book, called, *Machinæ cœlestis pars prior, Organographiam Astronomicam exhibens, &c.* The letter intimated, that the second part of this work, containing all the author's celestial observations, was also in the press.

3. A letter of Mr. Lister to Mr. Oldenburg from York, dated 2d September, 1673[2], signifying his own invention of a blood-staunching liquor, at least as good and efficacious as that of Monf. Denys, the French physician.

It was ordered, that Mr. Lister should be desired to send to the Society, either a specimen of his water for stanching of blood, or the preparation of it.

Sir Theodore de Vaux read a paper, containing a narrative of the case of a

[1] Letter-book, vol. vi. p. 225. [2] Ibid. p. 263.

O 2 young

young woman, who had, according to the account of many credible witnesses, and his own examination, lived without food for several years. He was desired to give this account to be registered, which he promised to do.

November 6. At a meeting of the COUNCIL were present

The lord bishop of Salisbury in the chair,

The earl marshal,	Mr. COLWALL,
The earl of DORSET,	Mr. HILL,
The lord visc. STAFFORD,	Mr. OLDENBURG,
Sir JOHN LOWTHER,	

Mr. OLDENBURG reported to the council, what he had found upon the council-book, concerning Mr. POVEY's business spoken of at the last meeting, viz. that 18th May, 1664, there was an order made, that the treasurer of the Society should reimburse to Mr. POVEY the expences, which he then alledged to have been at for the Society's service.

Whereupon it was ordered, that Mr. COLWALL should be desired to state Mr. POVEYS's arrears due to the Society, and subduct from them the sum demanded by him, and receive from him the remainder of his arrears.

It was ordered also, that the treasurer of the Society, Mr. COLWALL, do send to such fellows of the Society, as were in arrears, to acquaint them with the new regulation, which the council is now making, for a firm establishment of the said Society: and that therefore the arrears due to the Society are to be forthwith collected; and also a legal obligation to be subscribed by as many as should desire to continue fellows, for the better securing the weekly contributions for the future. And that therefore every fellow being in arrears shall be desired by the treasurer either to send in, between this and St. Andrew's day next (being November 30, 1675) all his arrears, or at least to give a sufficient bond to pay the same within, or at the end of six months from the date of this order, and to declare withal, whether he will continue a member of the Society, and comply with the aforesaid subscription.

After this the earl marshal was acquainted by the council with their thoughts of removing their weekly assemblies to Gresham College, and of beginning to meet there again upon the next anniversary election-day; the council being moved thereunto, by considering the conveniency of making their experiments in the place where Mr. HOOKE, their curator, dwells, and that the apparatus is at hand; as also by the solemn invitation of the city of London, and the professors of Gresham College; and likewise from the hopes, which they find grounds to entertain, of meeting with some considerable benefactors at that end of the city. To which was added, that though this Society should thus remove their meetings, yet they were full of hopes, that his lordship would be so far from removing his favours and kindnesses from them, that he would preserve them in the same degree he had done all along, and especially during the many years he had entertained them

them under his roof. To all which the council added this humble request, that the earl marshal would be pleased to give the council leave still to meet upon occasion in his lordship's house, there to enjoy the honour and advantage of his council and directions, which they had always found so affectionate and considerable to them.

Whereupon the earl marshal very obligingly and generously declared, that though he always had esteemed, and still did esteem it, a great honour to his house, that the Royal Society kept their assemblies there; yet understanding, that the council apprehended it really to be for the service and good of the Society to return to Gresham College, he could not but give up his reason to the reason of the council; adding further, that he should continue the same respect and concern for the Society, where-ever they met, and be glad to receive the council in his house upon any occasion of their meeting.

Which declaration of his lordship was so deeply resented by the council, that they unanimously desired the lord bishop of Salisbury, in their name, to give the earl marshal their very humble and hearty thanks for his extraordinary favour and bounty towards the Society, in receiving them so frankly and generously into his house, when upon the sad calamity of the fire of London they were destitute of a place of meeting; as also in entertaining them afterwards, for so many years together, with all the nobleness imaginable; superadding to all that his great munificence in giving them the Arundelian library, and heaping many other real expressions of generosity upon them. To which the council added this farther order, that the lord bishop of Salisbury should be desired to acquaint the Society itself, now ready to meet, with this whole matter, that they, concurring with the council in this affair, might present themselves in a body to the earl marshal, and make the like acknowledgments with the council; which was done accordingly, as appears by the entry in the Society's Journal-book upon this very day.

At a meeting of the SOCIETY on the same day,

JOHN STAFFORD HOWARD, Esq; was proposed candidate by his father the lord viscount STAFFORD, and immediately elected.

Sir JUSTINIAN ISHAM, knight and baronet, was also elected.

Mr. BOYLE prepared his book, intitled, *Several Tracts: of the strange Subtilty, great Efficacy, and determinate Nature of Effluviums: of new Experiments to make the parts of Fire and Flame stable and ponderable: together with some additional Experiments about arresting and weighing of igneous Corpuscles; as also, a Discovery of the Perviousness of Glass to ponderable parts of Flame: with some Reflections on it by way of Corollary:* printed at London in 1673, in 4to.

Mr. HOOKE shewed an experiment of water spreading itself, by a peculiar contrivance of a pipe, into a canopy (not a parabola, as is the ordinary way) and

reverts

reverting into the perpendicular, whence it came. Which figure he ascribed to the water's tenacity.

Sir WILLIAM PETTY was of opinion, that the first impetus of the sallying water being too strong for the pressure of the ambient, spread itself abroad in that figure of a canopy; but that afterwards, the first impetus being abated, the ambient was able, by its pressure, to make the water return to its first perpendicular.

The lord viscount STAFFORD upon occasion mentioned, that he had kept mercury for six or seven years, in a bolt-head, upon the fire, in a sand furnace, with a paper only on the top of it, and that it still remained unaltered. He promised to give the Society a more particular account of this at their next meeting.

Dr. WALTER NEEDHAM mentioned somewhat like this done by himself; which he was desired to give a fuller account of.

Sir WILLIAM PETTY suggested on this occasion, that it would be worth while to make all sorts of experiments with mercury. To which he added, that as mercurial experiments should be one head for the Society's entertainment, so experiments of the magnet, of optics, and especially of motion, should make some of the other heads, that the Society should take in hand and pursue constantly.

Mr. OLDENBURG began to read Dr. SWAMMERDAM's answer to the letter written to him by three of the physicians of the Society, Dr. CROUNE, Dr. WALTER NEEDHAM, and Dr. KING, containing their report to the Society, about some anatomical controversy between Dr. SWAMMERDAM and Dr. de GRAAF[t]: but there not being time enough to make an end of it at this meeting, the reading of it was referred to the next. The letter was as follows:

" Illustrissimæ Societati Regiæ

" S. P. D.

" GULIELMUS CROUNE,

" GUALTERUS NEEDHAM,

" EDMUNDUS KING.

" Quandoquidem ab illustrissima Societate Regia nobis tradita est illa de vi-" rorum clarissimorum Drs. SWAMMERDAM & Drs. de GRAAF scriptis cognoscendi " provincia; ea, qua decuit obedientia, munus, alias & invidiæ & difficultatis ple-" num, in nos suscepimus.

" Primo itaque in loco, utrique ab illustr. Societate gratias deferri existima-" mus, quod (quum & ipsi per totam dudum Europam meritis suis inclaruerint,

[t] It is inserted in the Letter-book, vol. vi. p. 241.

" &

" & etiam in Belgis sibi notos & familiares habeant viros, uti in omni genere doc-
" trinæ, ita præsertim in anatome versatissimos,) nos in hac controversia ap-
" pellare maluerint, quam judices conterraneos, vel alios ubique celebres viros,
" quorum fama & in re-publica anatomica dignitas jus in hac lite dicendi autorita-
" tem sibi vindicare videbatur.

" Id eo magis tantorum virorum candori tribuendum est, quod gliscente licet
" inter nos & Belgas bello atrocissimo, tamen eam philosophiæ felicitatem per-
" mittunt, ut inter literatos bonarumque artium cultores amicitia vetus, tam so-
" lido fundamento innixa, neutiquam labefactetur. Controversia vero hisce li-
" bris agitata videtur ad duo potissima capita reduci posse. Quorum *illud* de
" inventorum authore agit; *hoc* de descriptionum & sententiarum prolatarum
" veritate. De inventionis laude certantibus nescimus quid satis apposite a nobis
" responderi possit, quibus & res ipsa scitu ardua, & argumentum nimio nimis
" ingratum videbatur. Quem enim alium inventionis ordinem nos exhibere pos-
" sumus, quam quem dudum typothetæ exhibuerant? ut nempe post STENONEM
" GRAAFIUS, inde vero HORNIUS, tandem KERKRINGIUS, rursum GRAAFIUS
" gemino tractatu, demum SWAMMERDAMIUS, & postremo RUISCH, vel de or-
" ganis generationi inservientibus, vel de ovis viviparorum, scripta sua evulga-
" rint.

" Quæ in libris illis tractentur argumenta, lectoribus obviam est: quibus vero
" artibus alter alterum præveneri, illud nobis minime innotescit; qui in viris
" prædictis omnibus arcana philosophica indagandi peritam admodum sedulita-
" tem laudamus. Fieri interim potest, ut sine omni plagii crimine, qui forte
" posterior in inventum aliquod præclarum inciderit (de quo tamen hic nihil pro-
" nuntiamus) primus illud orbi literario exponat, & vel eo nomine diligentiæ suæ
" præmium ferat. Tales sane segnitiei suæ pœnas luent anatomici apud nos-
" trates non pauci, qui multa tum in hoc ipso, tum in variis argumentis ana-
" tomicis apud se diu presserunt, donec in aliis similis inveniendi felicitas editione
" magis prompta & expedita nobilitata est.

" Quod vero sententias ipsas utrinque prolatas attinet, illic, virorum clar. venia
" præfata, judicium nostrum interponere audebimus.

" 1. [u] Itaque arteriam spermaticam virilem recte descripsisse Dom. GRAAFI-
" UM autoptæ asserimus, nec quæ sit illa a naturali fabrica recessio, cujus ipsum
" accusat Dr. SWAMMERDAM, hactenus intelligimus. Descriptionem HORNIANAM
" a tauro ad hominem infeliciter transferri, ex utriusque scriptis & ex reipsa
" constat: interim non negamus, naturam in exiguis arteriolis ita ludere, ut etiam
" ab his differre possint vasa Dom. SWAMMERDAM observata. Quid enim fre-
" quentius in anatomia occurrit, quam varietas illa, qua in minoribus abundare
" solet?

" 2. [x] De tubulorum in testiculo, qui in epididymidem desinunt, deductione

[u] Mirac. Nat. p 5. Part. genit. defens. pag. 22. [x] Mirac. Nat. p. 8. Part. genit. defens. p. 25.

 " affir-

" affirmanti GRAAFIO assentiri cogit modestia, idque eo magis, quoniam & a Dom.
" VANDER WYEL id factum allegat, tum quia e nobis unus idem frequenter præ-
" stiterit, qui tamen affirmat, vasa illa non semper eodem tenore & numero tes-
" ticulo exire, ut epididymidi jungantur; neque in ejusdem generis subjectis duo
" per omnia invicem consentientia a se inveniri; neque revera multum refert, an
" duobus vel pluribus ductibus testiculo exeant hæc vasa, quæ in unum epidi-
" dymidem certo certius coiunt.

" 3. [y] De medio, per quod semen a sanguine in testiculo separatur, difficile est
" quicquam statuere. Non fieri illud per aliquam vasorum anastomasin, suadere
" videtur rei ratio & vasorum in testiculo structura. Nempe arteria illuc immissa
" eadem opera & tubulis seminalibus succum suum & venis sanguinem ministrat:
" idque ita fieri credibile est, ut omnis arteriola capillaris, ut ut minutissima,
" utrumque officium præstet. Raro hujusmodi secretionem perficit natura sine
" alterius corporis interventu. An vero glandulæ, ut ut exiguæ, intersint, an
" solis membranulis, quæ hic frequentes sunt, res perficiatur, aliis judicandum
" relinquimus. Nemo nostrum glandulas ibidem conspexit. Determinationem
" hujus quæstionis doctorum virorum ulteriori diligentiæ commendamus.

" 4. [z] De vesicularum seminalium cum deferentibus communicatione, & de
" succorum seminalium numero, difficilior est controversia. Etenim in homine,
" antequam vas deferens urethræ inseritur, dilatatio quædam est, sive cloaca com-
" munis utrique parti, viz. sive epididymidi, sive vesiculæ exonerandæ idonea.
" Si hujusce fabricam probe contemplemur, videbimus, nihil in tota illius loci
" structura impedire, quo minus vel hac vel illac profluat liquor, sive a defe-
" rente in cavitates vesiculæ, sive etiam vice versa, quo minus junctis viribus suc-
" cos utrumque organon per eandem sentinam simul & semel dejiciat. Hujus rei
" determinatio ex aliorum animalium analogia petenda videtur.

" Vesicularum harum cum vasis deferentibus schematismum, quatenus in ho-
" mine se habent, satis fideliter expressit Dr. de GRAAF; a quo si in pauculis dis-
" sentiat Dr. SWAMMERDAM, minoris illud nobis momenti videtur, & ad con-
" suetos naturæ lusus referendum. Si quid ab accurata descriptione desit illud prope
" exitum vasorum in urethram observamus, quo in loco vasa deferentia utrinque
" in * * * vel vesiculam exiguam dilatantur, quæ carunculæ in urethra appo-
" sitæ subjacet, adeo ut caruncula illa hujusce portio videatur.

" Hoc interim certum est tum de homine tum de equo (quod genus anima-
" lium homini quoad vasa generationis proximum est in utroque sexu,) quod stylus
" vasi deferenti immissus in urethram usque protendi facile potest. Si vero aut
" flatu aut liquore rem tentaveris, prius implebitur vesiculæ seminalis cavitas,
" quam quicquam in fistulam urinarium exiverit. Latius nempe est & patentius
" illud diverticulum, nec ulla valvula donatum, cujus beneficio motus liquoris,
" quoquo versum impulsi, sisteretur: cum interim vasis differentis extremitas ca-

[y] Mirac. Nat. p. 9. Part. genit. defens. 25. [z] Mirac. Nat. p. 10. Part. genit. def. p. 26, 27.

" runcula

" runcula obturetur, quæ tum in viventibus extra coitum, tum in mortuis quo-
" que occlusa jacet, nec prius aperturam patitur quam impletis vicinis cellulis
" tota impellentis vis in illum solum dirigatur. Hinc fieri posse credibile est, quod
" in homine & equo si quid seminis extra coitum testiculo effluat, in cellulam hanc
" concedere potest; donec illa quoque impleta tandem eruptio consequitur, quæ,
" nisi œstro venereo fiat, plerunque noctu in lecto calentibus contingit, & pollutio
" nocturna appellatur. In coitus vero tempore per quandam συμπραξίαν partium una
" eademque opera utramque partem simul exonerari credimus, quam sententiam
" & GRAAFIUM privatis ad Dom. OLDENBURGIUM literis agnovisse intelligimus.
" Interim vero an vesiculæ illæ humanæ sint mera seminis ita delati conceptacula,
" an non & aliquid de suo addant, etiamnum quæri potest? Certe consimilis ei,
" quoad communionem cum deferentibus, vesicula equina in posteriore sua parte
" egregie glandulosa est; nec videtur vesiculæ humanæ folliculus a glandulosa na-
" tura abhorrere. Imo hanc partem vasis varii generis copiose instructam micro-
" scopium abunde detegit. Unde conjectare licet, iisdem separari humorem quen-
" dam usui generationis inservientem; idque eo magis, si alia animalium genera
" expendamus. Qui enim aprum, arietem, caprum, taurum, sub cultro habu-
" erit, videbit quam evidentissime, vas deferens nullam omnino cum vesiculis
" seminalibus rem habere. Instantiam ponimus in apro, ubi vesiculæ seminales
" maximæ sunt, & aliquot seminis libras in se continent. Quum harum succus
" cum semine testiculorum confertur, videbimus multis gradibus ab invicem dis-
" tare; ut ille testiculorum liquor ex albo flavescens florem lactis tum colore tum
" substantia commode repræsentat. Si vero gustaveris saporem, exhibet insigniter
" dulcem cum astrictione, qualem in saccharo Saturni agnoscimus. Interim vas
" deferens, licet per vesicularum seminalium meditullium transeat, tamen ne mi-
" nimo quidem porulo in easdem hiat, sed canalem suum in urethram recte aperit.
" Vesicularum interim succus pellucidus est & coloris aluminosi ex crystallino sub-
" albicans. Sapit fere cremorem tartari, pauco alumine adulteratum. Exit in
" urethram per foramina vesiculis propria: neque stylo, injectione, aut flatu quo-
" libet, harum cum deferentibus communio detegi potest. Quod ipsum de reli-
" quis animalibus modo recensitis verissimum.

" Ex dictis conjectura deduci videtur, quod numerus succorum seminalium
" sequitur organorum ipsorum numerum. In piscibus nempe oviparis, & avibus,
" simplex est & unicus; in cane duplex, utpote cui desint vesiculæ seminales;
" pene dixeramus in tauro duplicem esse, utpote cui tantum non desunt prostatæ,
" exiguæ enim sunt & intra musculos, penis directores, adeo absconditæ, ut
" anatomicum mediocriter peritum fallere possent. In arietibus, capris, et apris,
" manifesto triplex est. Idem de equo dicendum est, nisi insignes glandulas (e qui-
" bus constat posterior portio vesicularum seminalium) nihil excernere dicamus.
" Quidni & hominis eadem sit ratio? Nos tamen nihil hic audacter asserimus, ve-
" rum ulteriori disquisitioni remittimus. Interim notandum est, duplicem saltem
" succum etiam in homine concedere Cl. GRAAFIUM, viz. testiculorum & prosta-
" tarum, quem tamen posteriorem seminis appellatione non dignatur, sed vehiculum
" seminis vocat, quod gratis dici videtur: saltem controversiam ad logomachiam
" deducit. Interim optamus, ut periculum faciat vir doctissimus de excindendis ve-

" ſiculis ſeminalibus[a]; tum demum experiatur, an animalia hoc novo caſtrationis " genere multilata generationi æque fere idonea futura ſint ac antea fuerunt. Nos " majora de naturæ in conſtruendis organis ſolertia credimus[b]. Digniſſ. SWAMMERDAM quadruplicem ponit materiam ſeminalem; quartum nempe ſuccum e vaſe " deferente prope urethram glanduloſo petit. Iſte vero ſuccus videtur ipſis ductus " hujus parietibus in illa confluentia liquorum (viz. teſticuli & veſiculæ) ungendis " inſervire, ut liquoribus liberior tranſitus permittatur. Si tamen obtineat iſte " cenſus, poſſumus nos in apro quintum aſſignare, non ex epididymide petitum, " (ut per jocum vult GRAAFIUS) verum ex glandulis peculiaribus majuſculus, " medijs veſiculis ſeminalibus[c] innaſcentibus, urethræ vero ſeorſim implantatis.

" 6[d]. Penis impletionem a ſanguine infarcto pendere utrobique aſſeritur. " Quæſtio eſt de rigiditate, quam GRAAFIUS potius animalibus ſpiritibus, corporum nervoſorum tunicam diſtendentibus, tribuendam cenſet: idque ea ductus " ratione, quod penis injectionibus utcunque impletus tamen minus rigidus eſt, " quam in vivo animali apparere ſolet. Idem tamen (de viror organ. pag. 154.) " ſcribit ſe in cadaveribus, aqua, beneficio ſyringæ, in corpora nervoſa per arterias propulſa, penem adeo extendiſſe, ut in vivis vix magis poſſet. Porro in " canis pene, quem coitus tempore retro veſiculum firmiter ligaverat, præter " ſanguinem floridum ſe nihil reperiſſe affirmat. Si quid hic a vivi penis rigiditate deficiat, nonne potius fibris in cadavere reſolutis tribuendum eſt, quam " peculiari alicui ſpirituum animalium influxui deficienti? Fatemur quidem, " ſpirituum acceſſione fieri, ut in vivis vigorem & tonum obtineant fibræ illæ, " quæ in mortuis flacceſcunt: ſed hoc toti corpori cum pene commune eſt, neque " peculiarem hic loci ſpirituum affluxum poſcit. Inſuper probabile eſt, ſanguinem, a corde in vivo animali per vaſa naturaliter conſtituta in vivum & calentem penem impulſum, poros ejuſdem magis univerſaliter & adæquate implere, " quam id aqua in defuncto fieri poteſt. Idque eo magis credibile eſt, quia arteria in mortuis inflata veram rigiditatem reſtituit[e].

" 7[f]. At illa de emiſſione ſeminis quæſtio a neutro ſcriptorum ſolvi videtur. " Dicit quidem Cl. HORNIUS, ex urethræ ſtructura facile intelligi, cur tam magna " adſit in pene tenſio, & tam impetuoſa ſeminis per eundem jaculatio. Utinam " illius ejaculationis rationem pluribus exhibuiſſet vir clariſſimus, & in re ſibi " adeo perſpicua cæcitati noſtræ gratificatus fuiſſet. Etenim ſemen cum impetu " proſilire conſtat. Quorum vero muſculorum ope vibretur, vel qua alia vi explodatur, non adeo clarum eſt. Teſticulis quidem additos videmus cremaſteres; " forte illi potius uſui deſtinatos, quam meræ teſtium ſuſpenſioni, quæ æque " membrana peragi potuiſſet. Quid vero veſiculas ſeminales premit, & in " œſtri venerei ἀκμῇ tam ſubitaneo motu exonerat? Quid glandulis proſtatis " ſuccum ſuum exprimit? Quid in omnibus hiſce ſimultaneam eam συμπραξίαν " excitat? Proſtatas quidam aprugnas muſculis validis donari agnoſcimus. " Neque enim aliter exprimi potuit tam viſcidus liquor, qui in illo animali " quovis glutine tenacior eſt. Verum veſiculæ ſeminales illic aliquot libras

[a] Part. Genit defenſ. p. 31.
[b] Mirac. Nat. 5. p. 11.
[c] Mirac. Nat. p. 13.
[d] Part. Genit. defenſ. p. 32.
[e] Mirac. Nat. p. 12.
[f] Part. Genit. defenſ. p. 6.

" con-

" continent humoris, non in unica aliqua cavitate fluctuantes, sed in vesi-
" culis innumeris, ad methodum fere pulmonum MALPIGHIANORUM recon-
" diti. Nullo interim musculo comprimuntur, neque quo pacto se emulgeri
" sinant, facile comperimus. Quod ipsum de plerisque saltem animalibus verum
" est. Solas talpas excipit doctiss. SWAMMERDAM, quorum et vesiculis seminali-
" bus & epididymidibus musculos appendi asserit. Interim suam de ejaculatione
" seminis sententiam addit [g], in qua primo affirmat, seminis motum a toto san-
" guine pendere, & non nisi tempore coitus excerni. At contrarium evincit
" aprugna dissectio, ubi nunquam non multas uncias seminis invenies, licet in
" toto anno procedente non coiverit, nec sui appropinquaverit. Secundo [h], univer-
" salem eo tempore musculorum corporis omnium contentionem, præcipue vero
" eorum, qui ad partes seminales pertinent, assignat tanquam excretionis causam.
" At vero, quomodo motus ille comprimet vesicularum semiralium manticam a
" musculorum horum tergo pendentem, & plerunque, si non semper, semine
" gravidam, doctiss. GRAAFIUS, descripta prius erectionis & compressionis ure-
" thræ ratione pergit dicere: *urethræ compressione* (viz. musculorum ope) *e vesi-
" culis seminariis & vasis deferentibus in urethram propulsum semen, ibique menstruo
" suo* (sc. e prostatis affluo) *permixtum ulterius propelli posse.* Non libet integram
" hanc controversiam evolvere; unicum tantum rogamus, nempe, concesso,
" quod semen, postquam fistulam urinariam intraverit, a musculis penis vibratur
" & vi emittitur; quid demum est, quod semen illuc affert? Etenim tum testi-
" culi, tum vesiculæ seminales, tum etiam glandulæ prostatæ extra eorum mus-
" culorum, ut & ipsius urethræ, potestatem collocantur.

" 8. Complura in schemate SWAMMERDAMIANO, quod cl. Dom. TULPIO dica-
" vit, culpat GRAAFIUS, forte non immerito: quæ tamen omnia ab authore ipso in
" subsequentibus figuris postea editis emendantur.

" 9. De internis vero clitoridis cruribus (quæ Dr. SWAMMERDAM nonnunquam
" occurrere ait) asserit e nobis unus [i], se carnearum fibrillarum cylindrillos quosdam
" reperisse, musculis proxime adjacentibus distinctos, iis forte similes, quos no-
" tavit author modo laudatus.

" 10. Porro notat idem, ligamenta uteri teretia non vasa modo sed & fibras
" musculosas obtinere, & motibus quasi muscularibus inservire posse. Reliquæ
" inter hos duos viros agitatæ controversiæ minoris momenti esse videntur quam
" ut censuram mereantur. Londini, d. 15 August, 1673."

The lord bishop of Salisbury reported the sense of the council held this day to the Society, concerning their return to Gresham College, and represented what great obligations the Society had to the earl marshal, for having received them so generously at first, and entertained them so nobly for so many years in his house, acquainting them withal, that the council had already expressed their deep sense of such great favours to his lordship.

Whereupon the Society, concurring with the council about the returning to

[g] Mirac. Nat. p. 14. [h] Ibid. [i] Dr. KING.

Gresham College, resolved that they would presently in a body attend the earl marshal likewise, and join their humble acknowledgments with those of the council for his lordship's extraordinary favours and kindnesses to them, desiring the lord bishop of Salisbury, who was then in the chair, to be their mouth in this address: and this was done accordingly.

November 13. At a meeting of the COUNCIL were present

The lord bishop of Salisbury in the chair;

The earl marshal,	Mr. COLWALL,
Sir JOHN LOWTHER,	Mr. HILL,
Sir PAUL NEILE,	Mr. OLDENBURG.

It was ordered, that the following persons, or three of them, of whom the president and Mr. OLDENBURG were to be two, be a committee for auditing the accounts of the treasurer; and that they meet for that purpose on the Monday following, the 17th instant, about three of the clock in the afternoon, at the president's house; these persons being the president, Sir JOHN LOWTHER, Dr. GODDARD, Mr. HILL, and Mr. OLDENBURG.

It was ordered also, that the following bond be shewn by the amanuensis to Mr. LE HUNT; and upon his alteration, if he see cause for any, some copies be forthwith made and presented, or sent about by the treasurer, to be signed by those, who do not presently pay their arrears in ready money: and that such of the nobility, as should make use of this bond, yet so as to order their stewards to sign in their stead, should be complied with in this particular.

The bond was as follows:

"*Noverint universi per præsentes me teneri & firmiter obligari*
"*præsidi, concilio, & sodalibus Regalis Societatis Londini pro scientia naturali pro-*
"*movenda & successoribus in libris bonæ & legalis monetæ Angliæ solvend.*
"*eidem præsidi, concilio, & sodalibus, aut successoribus suis, aut eorum certo attor-*
"*nato: ad quam quidem solutionem bene & fideliter faciend. obligo me, heredes, exe-*
"*cutores, & administratores meos firmiter per præsentes, sigillo meo, sigillat. Dat.*
anno regni Domini nostri Caroli II. *Dei gratia Angliæ, Scotiæ, Franciæ,*
"*& Hiberniæ Regis, Fidei Defensoris, &c. vicesimo tertio, annoque Domini,* 1673.

"The condition of this obligation is such, that if the above bounden
" his heirs, executors, administrators, or assigns do well and truly pay,
" or cause to be paid, unto the above named president, council, and fellows of
" the Royal Society, or their successors, or assignee or assignees, the full sum of
" of lawful money of England, it being his arrears due to the
" president, council, and fellows of the Royal Society aforesaid, according to his
" engagement upon his admission into the said Society, on the day
" of next ensuing the date hereof, to the use of the said president,
" council,

"council, and fellows, and their ſucceſſors; then this obligation to be void, or
"else to remain in full force and virtue.
"Sealed and delivered,
"in preſence of

It was reſolved, that for want of time, the execution of that part of the order made at the late council of November 6th, which relates to the legal tie to be ſubſcribed for ſecuring the weekly contributions for the future, be deferred till after St. Andrew's day.

At a meeting of the Society on the ſame day,

Dr. WALLIS paid to the treaſurer forty ſhillings for Mr. BERNARD's admiſſion-money, having received orders ſo to do from Mr. BERNARD, whoſe occaſions would not yet permit him to appear in perſon at the Society.

Mr. OLDENBURG preſented to the Society, from Mr. BOYLE, his new book, intitled, *Tracts, conſiſting of Obſervations about the Saltneſs of the Sea: an account of a ſtatical Hygroſcope, and its Uſes; together with an Appendix about the Force of the Air's Moiſture: and a Fragment about the natural and præternatural ſtate of Bodies: by the honourable* R. BOYLE: *to all which is premiſed a Sceptical Dialogue about the poſitive or privative nature of Cold, by a member of the Royal Society:* printed at London, 1673, in 8vo.

Mr. HOOKE was called upon for his account of the experiment made November 6. of water ſpreading itſelf into a canopy, and reverting to the perpendicular. He excuſing himſelf, that he had not been able to make it ready, was deſired to prepare it for the next meeting.

He ſhewed an experiment concerning the ſpringineſs of glaſs, by applying to a ſlender glaſs-pipe a wax-light on all the ſides thereof, by which it appeared, that the light being held on the top of the pipe, the farther end of the pipe ſunk; held underneath, it roſe; held on the ſide towards the hand applying, it turned from him; held on the oppoſite ſide, it turned towards him.

The cauſe of this phænomenon was by ſome conceived to be the expanſion of the glaſs on that ſide, where the light is applied.

Sir WILLIAM PETY ſaid, that it was a deſireable thing to have a good theory of the ſpringineſs in bodies.

Mr. HOOKE mentioned, that formerly he had explained it, in a diſcourſe of his, brought in upon the occaſion of the odd phænomenon of the pipe of mercury ſtanding top-full far above the ordinary ſtation.

He was deſired, ſince that diſcourſe was not yet brought in by him, that he would bring it in; which he promiſed to do.

He

He promised also to bring in some experiment or other at the next meeting.

Mr. OLDENBURG read a paper of Mr. LISTER, containing an account of some of the parts of certain stones figured like plants, together with thirty-seven figures, curiously drawn to represent the same [l].

November 20. A committee was chosen by ballot, for auditing the treasurer's accounts, consisting of Sir WILLIAM PETTY, Sir THEODORE de VAUX, Mr. CREED, Mr. HOOKE, and Mr. VERNON, three of whom were to be a quorum, and to meet on the Thursday following, November 27. about two in the afternoon, at Arundel House.

The lord bishop of Salisbury acquainted the Society, that those eminent citizens of London, who had been formerly deputed by the city and the Mercer's company, to invite the Royal Society to return to Gresham College, viz. Sir JOHN LAURENCE, Sir RICHARD FORD, Sir THOMAS PLAYER, and Mr. ROWLAND WYNNE, had upon occasion expressed, that they should esteem it as an honour to be elected into the Royal Society: whereupon his lordship now proposed them all four as candidates, and desired the Society to meet the next week, in such a number as was requisite to make an election.

Mr. ANDREW BIRCH was proposed candidate by Sir THEODORE de VAUX.

Mr. HOOKE shewed a microscope, with one only globule of glass, fastened to an instrument with many joints, to turn every way, and so to shew the object on every side with greater distinctness than other microscopes: which kind of microscope, he said, a German had brought over with him out of Holland, but that it had been long since hinted by himself in the preface to his *Micrographia*.

He was put in mind both of his account of the experiment made November 6, with water, and of his discourse concerning elasticity.

Mr. OLDENBURG presented from Mr. HEVELIUS his book, intitled, *Machinæ Cœlestis pars prior, Organographiam Astronomicam exhibens, &c.*

November 27. At a meeting of the COUNCIL of the Society were present,

The lord bishop of Salisbury in the chair,

The earl marshal,	Sir PAUL NEILE,
Mr. CHARLES HOWARD,	Mr. COLWALL,
Sir JOHN LOWTHER,	Mr. HILL,
Mr. AERSKINE,	Mr. OLDENBURG.

The receit for the four hundred pounds, bequeathed by the late Dr. WILKINS, bishop of Chester, deceased, to the Society, was signed and sealed in council,

[l] Letter-book, vol. vi. p. 371 and 339. It is printed in the Philos. Transact. vol. viii. n° 100. p. 6181. for January and February, 167¾.

cil, and ordered to be delivered to Dr. TILLOTSON, dean of Canterbury; and Mr. COLWALL, the treasurer, was desired to keep the money in his custody till farther order.

The committee of the council for auditing the treasurer's accounts made their report [k].

At a meeting of the SOCIETY on the same day,

Sir JOHN LAURENCE, Sir RICHARD FORD, Sir THOMAS PLAYER, Mr. ROWLAND WYNNE, and Mr. ANDREW BIRCH were elected into the Society.

Mr. ELERS, a foreigner, shewed the Society a small agate, of the size of a pea, having on the one side the perfect effigies of a face, resembling naturally, as he affirmed, pope ALEXANDER VII. being compared with a medal of that pope, which Mr. ELERS had procured at Rome purposely for comparing the agate with it on this occasion. On the other side appeared the face of the present emperor [l], if held one way, and another face, if held another way; besides several other faces, which the owner of the agate imagined to be there, but which could not well be discerned by any of the Society.

He shewed likewise several patterns of stuff, which by the press had received the likeness of cloth of gold and silver; for the making of which manufacture in England, he said, a certain German, then in Holland, intended to procure a patent.

The lord viscount STAFFORD brought in an account in writing, of what he had related 6th November, concerning the unaltered quicksilver, notwithstanding it had been on the fire for the space of fifteen years: to which was added an account of the increase of weight in brimstone by fire. It was ordered to be entered in the Register-book [m].

Mr. HOOKE shewed an attempt of his, of making a vessel so thin, that when evacuated of the air contained in it, it might swim in the air. He mentioned also, that a certain Italian clergyman, named LANA, had written upon this subject; whose book he thought had been formerly presented to the Society by their secretary, but was still in his hands.

December 1. St. Andrew's day, November 30. having this year fallen upon Sunday, the Society, by virtue of their charter, kept their anniversary election upon this day; at which, were present five and fifty members.

Sir JOHN LAURENCE, Sir RICHARD FORD, Sir THOMAS PLAYER, Mr. ROWLAND WYNNE, and Mr. ANDREW BIRCH were admitted.

[k] This report was forgot to be entered in the Council-book, vol. i. p. 225.

[l] LEOPOLD.

[m] It is not entered there.

The

The committee of the Society for auditing the treasurer's accounts made their report, as follows:

" At a committee of the Royal Society for auditing the treasurer's accounts, " November 27, 1673,

" We find Mr. DANIEL COLWALL debtor,

	l.	s.	d.
" To monies he hath received on the quarterly payments of the So- " ciety from 23d November, 1672, to 13th ditto, 1673 - -	142	19	6
" To money he hath received for admission - -	2	0	0
" To the balance of his last account - - - -	7	9	3
	£ 152	8	9

" We also find he is creditor,	l.	s.	d.
" By monies he hath paid to the use of the Society - -	146	16	8
" Balance resting in cash in his hand - - -	5	12	1
	£ 152	8	9

" Signed,

" WILLIAM PETY,
" THEODORE de VAUX,
" FRANCIS VERNON,
" ROBERT HOOKE."

This done, the Society proceeded to the work of this day; and by their election there were continued of the council these eleven, viz.

The lord viscount BROUNCKER,
The lord BERKLEY,
Mr. COLWALL,
Dr. GODDARD,
Mr. HILL,
Mr. HOSKYNS,
Sir JOHN LOWTHER [a],
The earl of Norwich, earl marshal of England,
Sir PAUL NEILE,
Mr. OLDENBURG,
The lord bishop of Salisbury.

The new chosen members of the council were these ten, viz.

Mr. BOYLE,
Mr. BARRINGTON,
Mr. CREED,
Sir JOHN CUTLER,
Dr. WALTER NEEDHAM,
Sir WILLIAM PETY,
The earl of SHAFTESBURY,
Sir ROBERT SOUTHWELL,
Sir CHRISTOPHER WREN,
Mr. WYLDE.

Out of these were elected officers,

[a] This name is omitted in the Journal, vol. v. p. 48. but restored from the printed list of the Society for 1674.

The lord viscount BROUNCKER, president,
Mr. COLWALL, treasurer,
Mr. HILL, } secretaries.
Mr. OLDENBURG, }

Of the new members of the council were sworn Sir WILLIAM PETTY and Sir ROBERT SOUTHWELL.

Before this annual election the Society had an important loss by the death of

Sir ROBERT MORAY, who was descended of an antient and noble family in the Highlands of Scotland, and educated partly in the university of St. Andrews, and partly in France, where he had afterwards a military employment in the service of LEWIS XIII. [l], and gained so high a degree of favour with cardinal RICHELIEU, that few strangers were ever so much considered by that great minister as he was [m]. He was raised to the rank of colonel in France, and came over to England [n] for recruits, when king CHARLES I. was in with the Scots army at Newcastle, where he grew into great esteem with his majesty, for whose escape, about December, 1646, he laid a design in the following manner [o]: Mr. WILLIAM MORAY, afterwards earl of Dysert, had provided a vessel by Tinmouth, and Sir ROBERT MORAY was to have conducted the king thither in a disguise; and it proceeded so far, that his majesty put himself in the disguise, and went down the back stairs with Sir ROBERT: but apprehending, that it was scarce possible to pass all the guards without being discovered, and judging it highly indecent to be taken in such a condition, he changed his resolution, and went back.

Upon the restoration of king CHARLES II. he was made one of the privy council to his majesty in that kingdom. He was one of the first and most active members of the Royal Society, and as early as December 5, 1660, brought a message from the king, that his majesty had been acquainted with the design of their meeting, and well approved of it, and would be ready to give an encouragement to it [p]. March 6, 166$\frac{0}{1}$, he was chosen president of the Society [q], as he was again for another month on the 10th of April, 1661 [r]; and several times after [s]. In the first charter granted to the Society, of July 15, 1662, and the second, of April 22, 1663, he was nominated one of the council to it. He died suddenly in his pavilion in the garden at Whitehall, July 4, 1673, and was interred at the king's charge in Westminster-abbey near the monument of Sir WILLIAM DAVENANT [t]. Mr. WOOD affirms [u], that he was a *single man*, and an *abhorrer of women*; but this is a gross mistake, for Sir ROBERT married the sister of the lord BELCARRES [x]. He was universally beloved and esteemed; and eminent for

[l] WOOD, Athen. Oxon. vol. ii. col. 370.

[m] BURNET, History of his own Time, volume i.

[n] Mr. WOOD, *ubi supra*, says, that he had been general of the ordnance in Scotland against king CHARLES I. when the presbyterians of that kingdom first set up their *covenant*.

[o] BURNET's Memoirs of the Dukes of Hamilton, l. 5. p. 307.

[p] See above, vol. i. p. 4.

[q] Ibid. p. 17.

[r] Ibid. p. 21.

[s] Ibid. p. 85, 87.

[t] WOOD, *ubi supra*.

[u] Ibid.

[x] BURNET, Hist. of his own Time.

his piety, spending many hours a day in devotion in the midst of armies and courts. He had an equality of temper in him, that nothing could alter, and was in practice a stoic, with a tincture of one of the principles of that sect, the persuasion of absolute decrees. He had a most diffused love to mankind, and delighted in every occasion of doing good, which he managed with great zeal and discretion. His comprehension was superior to that of most men. He was considerably skilled in mathematics, and remarkably so in the history of nature; and his genius resembled that of the illustrious PEIRESKIUS, as described by GASSENDUS [y].

December 4. FRANCIS ROBARTES, Esq; son of JOHN lord ROBARTES, and Col. GILES STRANGWAYS, were proposed candidates by the lord bishop of Salisbury; as was likewise JOHN le GASSICK, M. D. by Sir WILLIAM PETTY.

The earl of Salisbury, Mr. BOYLE, Mr. BARRINGTON, and Mr. CREED, were sworn members of the council.

There was present at this meeting the abbé D'ANGEAU, brother to the marquis of that name, who had attended her royal highness the dutchess of York from Paris to London.

Mr. HOOKE shewed an experiment of the springiness of coal; which was, that one side of a piece of charked wood or coal being heated, that side did (as in the like experiment formerly made with glass) bend from the heat, as appeared by a long stick fastened thereto, and the end pointing to a fixed mark.

It was also tried again with a glass pipe, as likewise with a brass wire; which latter stirred but very little, and almost insensibly.

There was produced a microscope of Mr. SMETHWICKE's contrivance, said by him, as Mr. HOOKE reported, to have glasses not spherical, but of a conic section: which figure the author, as was said, affirmed he could make and polish with certainty. Being tried, some of the members found it shew the object very distinctly without any colours, and magnify it very considerably.

It was thought necessary to compare it with some very good ones of a spherical figure.

December 11. FRANCIS ROBARTES, Esq; Col. STRANGWAYS, and Dr. le GASSICK were elected.

Mr. HOOKE brought in an apparatus to shew by experiments the strength of the loadstone's attraction, and to find in what proportion it draws, at several distances.

He was ordered to fit this apparatus so, that the design of it might be well prosecuted.

[y] Idem, ibid.

Upon

Upon this occasion Sir WILLIAM PETTY moved, that the Society would give orders, that there might be a constant apparatus of instruments ready for the making of several kinds of experiments depending on several heads; for instance, for experiments of motion, optical, magnetical, electrical, mercurial, &c. And that such instruments, as had been formerly used by the Society, and were out of order, might be repaired, and all these put together in a room by themselves, to be ready upon occasion for strangers, or for repetition and farther prosecution of the several sorts of experiments.

Dr. GREW was desired to produce some botanical observations at the next meeting; which he promised to do.

Mr. OLDENBURG read a letter in Latin, written at Rostoch, 11th March, 1669 [z], addressed to the president and fellows of the Society, by Dr. SEBASTIAN WIRDIG, professor of physic at Rostoch, desiring the Society to give their judgment of his book dedicated to them, and intitled *Sebastiani Wirdig, M. D. Nova Medicina Spirituum, &c.*

It was thought strange, that the letter bore so old a date, and that there was such a distance between that and the publication of the book; which was delivered to Sir WILLIAM PETTY, that he might peruse it, and make a report of it to the Society.

Two letters of Signor CASSINI, dated 22d September, and 8th November, 1673, were read, containing some observations of his about the two lately discovered satellites of Saturn, and others concerning the diameter of the circumjovialists; together with an account of the charges and apertures of his glasses of thirty-five and twenty-one feet.

A letter of the lord HERBERT [a], returning thanks to the Society for his election, was read.

A letter of Monf. JUSTEL to Mr. OLDENBURG, from Paris, 26th September, 1673 [b], was likewise read; containing a description of the icy mountain, called Gletcher, in the canton of Berne in Helvetia.

Mr. BOYLE shewed the Society a little floating instrument of his, (called by him a *floating loadstone*) which discovers, whether guineas, for example, be counterfeit or not, by putting the instrument with the piece of coin to be tried and fastened to the bottom of it, into a tall glass or other vessel of water; certain marks being so made on the slender metalline pipe, which makes the upper part of the instrument, that the hollow ball, which makes the lower part of it, will sink much lower, at least two inches) if the coin be true gold, than if it be not; and

[z] This is the date in the Journal, vol. v. p. 52. but in the Letter book, vol. vi. p. 328, 329, the date is 1st March.

[a] Letter-book, vol. vi. p. 249.

[b] Ibid. p. 310. It is printed in the Philosoph. Transact. vol. viii. nº 100. p. 6191. for January and February, 167¾.

according as the water reaches to one or other of the aforesaid marks, an estimate may be made, whether the piece of coin, if counterfeit, be made of tin, brass, copper, silver, or lead. The same instrument may be applied to other gold coins; as also to silver coins, if they be of any considerable bulk.

The experiment was made several times by Mr. BOYLE's direction.

December 18. Mr. HOOKE produced again his instrument for determining the force of the loadstone's attraction at certain distances: but the apparatus still failing, he was desired to fit it better for the next meeting.

Dr. GREW shewed two figures of two microscopical observations, which he had made; one of the trunk of an ash tree, the other of that of a berberis, explaining both wherein their structure agreed, and wherein they differed. He promised to produce more observations of this kind at the next meeting.

Mr. OLDENBURG presented to the Society from Dr. THOMAS WILLIS his new book, intitled, *Pharmaceutice rationalis, sive Diatriba de Medicamentorum Operationibus in humano Corpore:* printed at Oxford, 1673, in 4to.

Dr. KING having already perused this book, gave some account of it to the Society, and mentioned particularly the author's description of an artery and of its muscular motion like that of the heart, promising, that he would bring in the scheme of an artery not added to Dr. WILLIS's book.

Mr. OLDENBURG delivered to the Society in the name of Signor PAUL BOCCONE, a Sicilian botanist, his collection of curiosities in three boxes, which, before his leaving England, he had desired to be presented to them for their repopository; containing the following particulars [c], transcribed out of a French paper left by the presenter with Mr. OLDENBURG, viz.

" Memoire du cabinet, que Monf. BOCCONE à presentè a la Societé Royale " l'an. 1673.

" 1. Le fruit de la musa, ou mauz de Prosper Alpinus.

" 2. *Papyrus Ægyptia penæ, sive papyrus nilotica Gerardi.*

" 3. *Fucus typhoides Melitensis coccineus.*

" 4. *Fucus sive alga spiralis maritima.*

" Toutes plantes rares et estrangeres; et plus

" 5. Pieces qui monstrent l'alteration et la petrification des herissons de mer;

[c] An account of part of them is printed in the Philosoph. Transact. vol. viii. nº 99. p. 6158.

" sçavoir *Echinus ovarius sive esculentus* dans le naturel, et petrifié: *Echinus spatagus* ou *Brisso* d' Imperatus et de Rondelet, dans le naturel; par ou l'on peut " examiner leur changemens: avec d' autres pieces et morceaux d' herissons de " mer, appellé de l' Imperatus *istrice marino*.

" 6. Pieces, qui monstrent la resemblance, qu'il y a entre les dents du poisson " carcharias, chien de mer, et semblables, avec les glossopetres, par ou l'on con- " jecture le changement des dites dents en perre.

" 7. Pieces, qui monstrent les parties, qui composent l' astroites ou la pierre " estoilleé par le moien de quelques tursaux coralloides, per celuy de la millepore " d' Imperatus; et par la structure de la meme pierre, qui n'est autre chose, " qu'un assemblage de *tophus* ou d' argille endurcie ensuite comme des pierres.

" 8. Pieces et parties, qui composent la corne d'Ammon, laquelle est remplie " de petites boules. Il faut prendre garde, que la corne d'Ammon d' Imperatus, " appelleé par d' autres *ebur fossile*, est tout autre chose.

" 9. Pieces, qui monstent, que la plus souvent les pierres, qui ont la figure de " coquille, ne sont autre chose que de l'argille renfermeé entre deux couvercles.

" 10. Pierres appellées *conchæ lapideæ gibbæ*, lesquelles, quoi qu'elles ayent la " figure de coquille, sont neantmoins produites *per juxtapositionem* comme d' autres " pierres ou des calloux: observation tres necessaire pour distinguer les precedentes " pierres, qui sont moulées par la compression des veritabiles coquilles.

" 11. Pieces et parties du desgorgement de Mont Ætna reduites en une matiere " ferrugineusée semblable au machefer, qu'on tire des fourneaux des forgerons: " sel armoniac blanc: sel armoniac taché de saffron, et sel armoniac taché d'une " couleur de vert gris; lesquells on à tirè sur la matiere embrasée apres que le feu " à esté estinct.

" 12. Figure de poisson, appellé cicerello à Messina.

" 13. *Sanguisuga pinnata*, qui succe le sang du poisson Xiphias, *pesce spadà*, " avec le poux et le capreoli, dans le naturel.

" 14. Pieces, qui monstrent l' observation de corail rouge et blanc étré veritable, " que le dit Boccone tient estre produit *juxtapositionem*, apres avoir esloigné le " corail de l'espece des plants, et dit, que le corail n'a point de semence. Il fait " voir son principe ou sa premiere impression sur un morceau de bois environné " de corail vray et solide et d' autre tendre comme du tartel coraillin par ou il à " conjecturé que les degres du corail veritable de Dioscoride ne sont qu'une " viscosité coralline, qui souvre et pousse des pores estoillees une espece de tartre, " qui est couvert de la dite viscosité ou *fucus* rouge, et le corail persait solide, et par " ou on croit pouvoir faire voir, que la nature du corail s'approche a celle des " pierres.

" 15.

"15. Pieces et morceaux de *corallium album punctatum stellatum*, pour faire "examiner combien ces especes de corail sont esloignées des plants.

"16. *Lapis fissilis bitumen redolens, in mentibus Hyblæis in Siciliâ repertus.*

"17. Pierre bezoar mineral Sicilien."

December 22. At a meeting of the COUNCIL were present

The lord viscount BROUNCKER, president,

The lord bishop of Salisbury,	Dr. WALTER NEEDHAM,
Sir JOHN LOWTHER,	Mr. COLWALL,
Sir PAULE NEILE,	Mr. HILL,
Sir WILLIAM PETTY,	Mr. OLDENBURG.

The council taking again into serious consideration the necessity of collecting the arrears due to the Royal Society resolved, that the following order should be delivered to such members of the Society, as were in arrears, viz.

"In pursuance of a former order of the council made the 6th of November, "1673, it was this day ordered, that the earl of Dorset, the earl of Aylesbury, "the lord viscount STAFFORD, Sir JOHN LOWTHER, Sir WILLIAM PETTY, Sir "PETER WYCHE, Sir CYRIL WYCHE, Sir THEODORE de VAUX, Sir CHRISTO-"PHER WREN, the treasurer and the secretaries of the Royal Society, and Mr. "HOOKE, or any four or more of them, be desired to apply themselves to such "members of the said Society, as are in arrears, and to acquaint them, that this "council being now upon making a new regulation for a firm establishment of "the said Society; in order whereunto the arrears due to the same are to be forth-"with collected; every fellow being thus in arrear is desired forthwith to pay "to the treasurer, Mr. COLWALL, or his deputy, so much thereof, as was due "at Michaelmass last, or at least to give a sufficient bond for the doing thereof "within the space of six months from the date of the aforesaid order.

"It was likewise then declared, that such of the fellows, as shall neither make "present payment of their respective arrears, nor give bond as aforesaid, shall "be accounted to have deserted the said Society, and be provided against accord-"ing to the statutes; and that the Society will proceed to a legal recovery of "the said arrears."

This order was signed by

The president,	Sir WILLIAM PETTY,
SETH, lord bishop of Salisbury,	Mr. COLWALL,
Sir JOHN LOWTHER,	Mr. HILL,
Sir PAUL NEILE,	Mr. OLDENBURG.

Dr. NEEDHAM went away before signing.

It

It was ordered likewiſe, that copies be made of the ſtatute for election, and of that for payment; as alſo of the obligation ſubſcribed by every fellow at his admiſſion; and that the committee named in the former order be furniſhed with ſuch copies, to be ſhewn upon occaſion to thoſe, whom they ſhall make application to:

That the ſaid committee be deſired to apply themſelves by letters to thoſe, who were in the country, and others, whom they could not have an eaſy acceſs to.

It was reſolved, that if any fellow ſhould be ejected on this occaſion, the cauſe of the ejection be recorded.

It was ordered, that Mr. BOYLE, Sir WILLIAM PETTY, Sir CHRISTOPHER WREN, Dr. GODDARD, Dr. GREW, and Mr. HOOKE, be deſired to draw up a liſt of conſiderable experiments to be tried before the Society, and to prepare an apparatus neceſſary for the exhibition of them upon all occaſions.

Sir WILLIAM PETTY was deſired to take a particular care of ſeeing the import of this order put into effect.

There being ſome members of the Society, the time of whoſe admiſſion did not appear upon the journal, as the earl of Angleſey, Sir JOHN BIRKENHEAD, Sir ROBERT HARLEY, and Mr. THOMAS HARLEY, it was ordered, that the printed yearly liſts of the Society ſhould be peruſed, to ſee what year thoſe members were printed the firſt time, and from thence a meaſure taken of ſtating their accounts.

After this it was thought convenient, that as many of this council, as conveniently could, ſhould meet in ſome other place, to avoid diſturbing the earl marſhal too long, and there make a diſtinction in ſeveral columns of the fellows of the Society, according as they conſtantly pay or not pay, and of ſuch, as are honorary, abſent, excuſed, or doubtful.

This was done accordingly by Sir JOHN LOWTHER, Sir WILLIAM PETTY, Mr. COLWALL, Mr. HILL, Mr. HOOKE, and Mr. OLDENBURG, who having found fifty-three fellows, who paid well, and ſeventy-nine, who did not, and fourteen abſent in the country, reſolved to apply themſelves with all poſſible ſpeed to the ſeventy-nine; and, in order to it, deſired, that the copies of the above-mentioned ſtatutes might be ſpeedily made, and the ſaid liſt of the ſeventy-nine fairly written out, together with the arrears due by every one of thoſe; as alſo that a letter might be drawn up by Mr. OLDENBURG, to be ſent by the committee to the abſent with all poſſible ſafety, acquainting them with the council's order of collecting the arrears, and deſiring thoſe, who were concerned, to give in their poſitive anſwer by the next poſt to the ſaid ſecretary.

December 25. being Chriſtmaſs-day, the Society did not meet.

1673/4. *January*

167$\frac{1}{2}$. *January* 1. The Society did not meet, it being New-year's-day.

January 5. At a meeting of the council were preſent

The lord biſhop of Saliſbury, vice-preſident, in the chair,

Sir John Lowther,	Mr. Creed,
Sir William Petty,	Mr. Colwall,
Sir Robert Southwell,	Mr. Hill.

It was diſcourſed, whether if any perſon pay fifty pounds, he ſhall be accounted a benefactor, according to the ſtatute, though part of the ſaid ſum be already due from him for arrears?

It was ordered, that the treaſurer pay into the Mercers company of London four hundred pounds now in the cheſt of the Society, taking their bond for re-payment, with ſuch intereſt as he could get for the ſame, not leſs than five per cent. and that the bond ſo taken be depoſited in the ſaid cheſt:

That the clerk give liſts of the perſons in arrears to the ſeveral members of the committee for demanding the arrears: And,

That the treaſurer give deputations to each of the ſaid committee to receive any ſum in arrear, and to give a ſufficient diſcharge for the ſame.

January 8. The Society did not ſit, there being but very few members preſent.

January 15. Mr. Hooke made an experiment with a ruler divided into ſuch parts, as being placed at a certain diſtance from the eye, appeared to ſubtend a minute of a degree; and being earneſtly and curiouſly viewed by all the perſons preſent, it appeared, that not any one preſent, being placed at the aſſigned diſtance, was able to diſtinguiſh thoſe parts, which appeared of the bigneſs of a minute, but that they appeared confuſed. This experiment he produced, in order to ſhew, that we cannot by the naked eye make any aſtronomical or other obſervation to a greater exactneſs than that of a minute, by reaſon, that whatever object appears under a leſs angle, is not diſtinguiſhable by the naked eye; and therefore he alledged, that whatever curioſity was uſed to make the diviſions of an inſtrument more nice, was of no uſe, unleſs the eye were aſſiſted by other helps from optic glaſſes.

Mr. Oldenburg produced a box containing ſome mineral concretes, together with a deſcription of them, preſented to the Society by Dr. Lucas Hodgson of Newcaſtle upon Tine, as himſelf had collected them from the tops and ſides of the ſubterraneal chimnies, as he called them, of a coal-mine betwixt Benwell and Fenham, near the ſaid town of Newcaſtle, which had burnt continually for forty years paſt. The particulars contained in diſtinct papers, were as follow:

A. Sulphur, with ſome flowers.

B. Sal

B. Sal armoniac of various forms and figures, ſome of it yellow, by reaſon of the ſulphur.

C. The white maſs (mentioned in the large deſcription) after it had lain in the air.

D. The white maſs newly brought from the fire.

E. Sal armoniac in ſoft flowers.

F. A piece of the marcaſite, or lapis pyrites.

G. Sal armoniac in ſplendid cryſtals of various figures.

H. Sal armoniac ſublimed, after it was taken from the fire.

I. Sal armoniac ſublimed, amongſt burnt whins and furzes.

K. A bottle of the ſpirit of this ſal armoniac, as it was taken from the fire.

L. The ſalt of a Spaw near Newcaſtle.

It was ordered, that the hearty thanks of the Society be given by a letter of the ſecretary to Dr. Hodgson, for theſe curioſities; and that he be deſired to continue ſuch communications, as he ſhould find occaſion.

It being moved, that Dr. Daniel Cox having made many obſervations and experiments concerning the nature and figures of all ſorts of ſalts, might be deſired to impart them to the Society, he was deſired accordingly, and promiſed, that he would do ſo, after he had viewed and examined ſuch ſalts by ſuch a microſcope, as had been approved of for its goodneſs by the Society: and a microſcope being brought by Mr. Cock to be examined, the trial of it was referred to a fitter time, it being then candle-light.

January 22. Mr. Hooke propoſed the making of a new kind of aſtronomical inſtrument of his own invention for the taking of hights, angles, and diſtances, of celeſtial bodies by one obſervation more exactly than ever was yet done, viz. to a ſecond. He added, that in this way the exactneſs of the inſtrument, as to diviſions, ſights, and perpendicularity, might, upon occaſion, be duly ordered by the aſtronomical obſerver, ſo as not to rely upon the credit or ſkill of the inſtrument-maker.

He being aſked, what the making of ſuch a quadrant would amount to, and anſwering, that he thought it could be made for leſs than ten pounds, it was ordered, that he ſhould cauſe one to be made of that price.

The experiment made at the laſt meeting, to ſhew, that with common ſights we are not capable to diſtinguiſh a minute, was repeated; and proved what it was deſigned for.

Mr. Oldenburg read a letter to him from Mr. Lister, dated 7th January, $167\frac{3}{4}$ [b], concerning an old *fungus subterraneus*, of a bituminous nature, found in a rocky lime ftone ground in Derbyfhire; as alfo an uncommon mineral liquor, white, refembling cream, found at the bottom of a coal-pit, and in iron-mines, in great quantity.

It was ordered, that Mr. Lister fhould be defired to fend a fpecimen of each of thefe curiofities, if he could fpare any of them.

Mr. Lister having formerly fent fome of his blood-ftanching liquor, with a defire, that trials might be made with it before the Society, it was ordered, that the operator fhould provide a dog againft the next meeting for that purpofe.

January 29. The Society did not meet.

February 5. Francis Robertes, Efq; was admitted.

Mr. Hooke produced a new kind of reflecting telefcope of his own contrivance, differing from that of Mr. Newton in this, that the obferver looked directly at the object erected. This was performed by a way propounded by Mersennus, and repeated in Mr. Gregory's Optics; but was thought to have been never actually done before.

Dr. Grew fhewed his microfcopical obfervations on the trunk of an oak and elm, much differing from one another in the pofition of their parts and veffels. He was defired to fhew at the next meeting his obfervations of the trunks of fome other trees.

Mr. Awbrey prefented fome written obfervations concerning winds, their blowing down many hundreds of oaks at once, their blowing very differently in places little diftant from one another, &c.

Mr. Oldenburg read a Latin letter to himfelf from Monf. Christopher Sandius, dated at Hamburgh, 15th December, 1673 [c], giving notice of the manner of the generation of pearls, viz. that originally they are the eggs of a kind of oifter, which ejects them to breed other oifters of the fame kind, but fometimes keeps one or two of them fticking to the fides of its fhell, where, to the trouble of the breeding fifh, they grow and become pearls of different fizes and fhapes.

It was ordered, that the writer of this letter fhould be thanked, and defired to let the Society know what ground he had for the truth of the matter of fact.

Dr. King, according to his promife, produced a piece of an artery of a bullock, as it is defcribed by Dr. Willis, in his late book *De Medicamentorum Ope-*

[b] Letter-book, vol. vii. p. 2. It is printed in the Philof. Tranfact. vol. viii. n° 100. p. 6179. for January and February $167\frac{3}{4}$.

[c] Letter-book, vol. vi. p. 346. It is printed in the Philofoph. Tranfact. vol. ix. n° 101. p. 11. for March 1674.

rationibus

rationibus in humano corpore, ſhewing the four ſeveral membranes, of which it conſiſts, viz. the vaſculous, glandulous, muſcular, and that which is contiguous to the blood; aſſerting withal the doctrine of Dr. WILLIS, that the motion of an artery is muſcular, and the ſame with that of the heart.

An experiment was made with Mr. LISTER's ſtyptic liquor upon a dog, by opening one of his crural arteries lengthwiſe without cutting it aſunder. The water was renewed three or four times, and at the end of about a quarter of an hour and a half the blood ſeemed to be ſtopped; whereupon the dog was ſet at liberty, and committed to the care of the operator.

February 12. At a meeting of the council were preſent

The lord viſcount BROUNCKER, preſident,

Sir JOHN LOWTHER,
Sir WILLIAM PETTY,
Sir ROBERT SOUTHWELL,
Mr. COLWALL,
Mr. HILL,
Mr. CREED,
Mr. OLDENBURG.

It was ordered, that a diſcourſe of Mr. ROBERT HOOKE about the ſtars be printed by JOHN MARTYN, printer of the Royal Society.

Sir WILLIAM PETTY and Sir CHRISTOPHER WREN were ſworn vice-preſidents of the Society by taking the oaths of allegiance and ſupremacy, according to the preſcript of the additional charter.

Mr. COLWALL and Mr. HILL acquainted the council, that the Mercers company had declared, that they had at preſent no occaſion for taking of any money; but the firſt they had, they would take the four hundred pounds of the Society, and pay intereſt for it.

Hereupon it was ordered, that the members of this council ſhould be deſired to inquire about a ſpeedy and ſafe way of diſpoſing of the four hundred pounds to the beſt advantage, and to report to the council concerning it at the next meeting thereof.

Mr. COLWALL produced a note from Dr. GASPAR NEEDHAM to himſelf, importing, that he deſired henceforth to be excuſed from his obligation to the Society.

At a meeting of the SOCIETY on the ſame day,

The Society inſpected the dog, upon whom the experiment had been made at the laſt meeting with Mr. LISTER's ſtyptic water, and found the dog very well, and the wound in a manner quite healed up.

It was ordered, that Mr. LISTER be acquainted with the ſucceſs of this experiment by a letter from Mr. OLDENBURG.

Mr. Hooke made ſeveral trials with a loadſtone, to find, whether the interpoſition of any body would hinder the power of its effluvia: and having by weight ſo poiſed a balance, fitted for this purpoſe, that the iron was made to hang at a certain diſtance from the loadſtone, ſo as to leave ſome room for divers bodies to be interpoſed, it was found, that though a ſilver crown, a piece of glaſs of about the ſame thickneſs, and four twenty ſhilling pieces of gold, called guineas, were ſeverally interpoſed between the iron and the magnet, yet the iron did not at all alter its diſtance, which at firſt it had by the poiſe.

It was ordered, that Mr. Hooke ſhould be deſired to try by himſelf a good number of experiments upon this ſubject, and draw up an account of their ſucceſs, and to communicate it to the Society, that ſo they might call for ſuch of them as they ſhould think good to be ſhewn before them.

February 19. There were made ſome more experiments with the magnet; viz. a ſmall bar of ſteel, of about one inch in length, and about a quarter of an inch diameter, was ſo ſuſpended, that the lower end was diſtant from the pole of a very good loadſtone, and counterpoiſed by ſix grains. And by ſeveral trials it was found, that a plate of glaſs, ſix inches broad, and half an inch thick, a thin board of wood about the ſame bulk, a plate of ſpar about the ſame breadth and thickneſs, a cut of butter on a trencher, a pewter-plate, a ſet of braſs-weights, a burning deal-board, a red-hot tile, a bright burning coal, the ſame alſo blowed, each of them interpoſed between the ſteel and loadſtone, ſuſpended as aforeſaid, made no variation of the attractive virtue of the ſtone: nor did an onion, ſlit in two, and laid upon the ſame ſtone, nor the interpoſing of lead, glaſs, wood, ſilver and gold, all at once, make any manner of change, the attraction remaining conſtant.

Farther, by the interpoſing of a knife, the virtue of the loadſtone was much diminiſhed; but by interpoſing a little bar of iron, half an inch in length, endwiſe, it increaſed about a quarter of the ſtrength.

The bringing of iron any wiſe near the ſtone weakened the attraction.

Dr. Grew ſhewed ſome microſcopical obſervations made upon a piece of the ſtem of a holly, and upon that of a fig-tree, both very curiouſly repreſented.

He was deſired to produce ſome more obſervations of this kind, at the next meeting.

Mr. Oldenburg read a letter to himſelf from Monſ. Slusius, dated at Liege, 8th February, 167¾ [d], N. S. containing an anſwer to the queries ſent him by Sir Joseph Williamson; which letter is as follows:

[d] Letter-book, vol. vii. p. 23.

" Nobi-

" Nobilissimo & Clarissimo Viro

" D. Henrico Oldenburg, Societatis Regiæ Secretario

" Renatus Franciscus Slusius.

" S. P. D.

" Quæsita tua philosophica, vir clarissime, misit ad me nuper excellentissimus " legatus idemque vir humanissimus, quo ferme tempore tuas 29 Decembris da- " tas accepi. Ad illa nunc respondebo paucis, rem totam uberius executurus, si " mihi post hac vel fide dignorum relatione, vel proprio experimento plura scire " contigerit.

" Lapis calaminaris non circa Aquisgranum modo, sed & prope Namurcum " pluribusque inter Sabim & Mosam locis effoditur. Nec soli Aquisgranenses ar- " tem æris eo tingendi vindicare sibi jure possunt: est quippe hac in patria Dio- " nantum oppidum ad Mosam eo nomine & nunc, & olim (Cominæo teste) ce- " leberrimum. De Thermis vero libellum edidit ab aliquot annis d. gallus " Franciscus Blondel, qui Aquisgrani medicinam exercet, & cujus diligen- " tiæ nihil modo est quod addam, pauca in hoc genere expertus. Didici tamen " a chemico experientissimo mihique amico, ex aquis thermalibus separari com- " mune sulphur magna copia: deinde salem, qui neque communis sit, neque ni- " trosus, nec ulli illorum similis, quibus nomen fecimus, sed sui generis; insipi- " dus quippe & minime lixiviosus, &, ut ipse aiebat, siccus. Idem retulit, aqua- " modice primum albescere, colorem deinde ex cæruleo ac viridi mixtum ins " duere. Cremorem, qui illis supernatat, nitrosum non esse, sed potius fuliginis " æmulum.

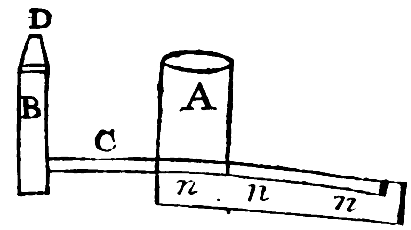
" Rectos fopinarum nostrarum carbonariarum puteos ad centum & ultra or- " gyiarum profunditatem deprimi, peritorum relatione mihi constat; atque inde " obliquo itinere ferme adhuc orgyias totidem descendere. Quod fortasse mirum " tibi videbitur V. C. cum 150 ulnarum profunditatem ad summum videaris " agnoscere. Est autem orgyia (sive toisa) pugnorum viginti, ut loqui solent ope- " rarii, sive pedum sex.

" Aëris in fodinas deducendi (sic enim loquuntur) hæc est methodus. Prope " rectum fodinæ puteum, fodiunt alterum multo minorem, aliquot orgyiarum " intervallo. Hunc æqualiter cum primo deprimunt; & eum ad 16 vel circiter " orgyias perventum est, cuniculum transversum inter utrumque puteum aperi- " unt. Cum puteus major deprimitur, deprimunt & minorem, & obstructo " priore cuniculo, alium inferiore loco substituunt; ita ut tum puteus uterque " tum cuniculi semper παραλληλισμὸν servent; & hoc quidem eousque, dum puteus " rectus est: cum vero in obliquum vergit, canalem quadratum ex asseribus com- " pactum aptant ad os cuniculi, & undique obstruunt, ne quid aëris nisi per cu- " niculum ingredi possit. Canalem hunc ad putei oblique descendentis latus ap-

" plicant,

" plicant, & pro ratione descensus semper augent. Rudi schemate rem totam
" tibi adumbrabo, quo me melius intelligas :

" A, est puteus major ; B, minor ; C, cuniculus
" inter utrumque apertus ; *n*, *n*, *n*, canalis lig-
" neus, quo aërem in fodinam obliquam du-
" cunt.



" Solent autem puteo minori tuguriolum imponere, trunci conici figura, qua-
" le est D. & super clathris ferreis transversis ad profunditatem aliquot orgyiarum,
" ut in B, ignem accendere, quo aër, ut aiunt, fortius trahatur. Quod si aërem
" excludi, sive canalem obstrui, contingat, maximum operariis ab igne pericu-
" lum est : bituminosæ nimirum ac sulphureæ exhalationes densantur ac concres-
" cunt, & a candelis fossorum concipiunt flammam, quæ mox miseros amburit.
" Ignem Græcum vocant nostrates, non inepte ; est enim inter hunc & illum si-
" militudo non exigua. Brevi definit, sed malignus adeo remanet fœtor, ut
" non minorem quam ipsa flamma noxam sæpe inferat ; vitam enim aliquando
" adimit. Non tamen in fodinis omnibus par periculum. In quibusdam enim
" nec adeo frequentes sunt exhalationes, nec tam cito in flammam erumpunt, nec
" si erumpant, fœtor adeo noxius sequitur.

" Aquas subterraneas, a quibus æquale, si non majus quam ab igne periculum
" est, (cum meminerim ad quadraginta una vice submersos) derivant in canales,
" publico, & privatorum etiam, sumtu constructos. Saltem si id fodinarum
" situs altior concedat, quales sunt in vicinis montibus, ex quibus fontes in hanc
" urbem defluunt : sin minus, vel situlis hauriunt, vel antliis, quales apud Agri-
" colam in lib. de *Re Metall.* videri licet.

" Venio nunc ad aquas Spadanas, quarum vires plurimum extulit *Spadacre-*
" *nes* auctor, plurimum depressit Helmontius, in quem idcirco invehitur al-
" ter. Sed neuter, ut existimo, modum servat. Negari enim non potest humores
" viscidos ac tartareos incidere, obstructiones tollere, ac sanare morbos, qui iis ori-
" ginem suam debent ; presertim si viribus non omnino dejectis, & ex medici
" prudentis consilio bibantur : sed non æque constat, morbos omnes, quos enume-
" ras, ab iis tolli, nisi forte κατὰ συμβεβηκός. Idem dictum puta de calculo labo-
" rantibus ; testari enim possum a multis ejectos calculos minores per uretheres de-
" lapsos, sed neminem novi, qui a vesica calculo curatus fuerit. Militis illius
" Itali historia refertur ab auctore *Spadacrenes*, & ætatem meam antecedit.
" In toto illo tractu, qui apud nos vetus *Arduennæ* nomen retinet, homines
" plerumque sunt μακρόβιοι, & minime morbis obnoxii. Scaturiunt etiam multis
" in locis fontes Spadanorum æmuli, minoris quidem famæ, sed virtutis, ut in-
" tellexi, non minoris. An vero his sanitatem & vitæ diuturnitatem debeant in-
" colæ, an potius vivendi rationi, & soli naturæ, plane mihi incompertum est.
" Parum enim fertilem terram colunt, & quæ ipsorum laboribus maligne respon-
" deat ; delicias nesciunt, atque ab adolescentia duram & exercitam vivendi ratio-
" nem

" nem fectantur. Ebrietatem aliquam potis aquis accidere, teftari poffum ; fæ-
" pius illam expertus, fed levem, nec diuturnam. Idque aliquando mihi in me-
" moriam revocavit quod legeram apud ANTIGONUM Ἐν ἱϛορίων παραδοξ. συναγωγῇ.
" de aquis acidis, quarum potores THEOPOMPUS auctor eft ὡς ἐπὶ ζῶν οἴνων
" ἀλλοιῶϛαι. Comune quoque eft omnibus, qui Spadanas bibunt, fordes atro co-
" lore foedas deponere, fed non vomere, nifi vel fint κακοϛομαχοι, vel fupra mo-
" dum fefe ingurgitent, vel ex Geronfterio bibant ; hic enim vomitum plerum-
" que movere folet. De cantu fontis Sanenirii nihil hactenus intellexi, fed Deo, bene
" juvante, inquiram. Optimo FRAMBESARIO fucum factum fuiffe exiftimo ; nam
" experientia me docuit, aquas Sanenirii non minus quam cæterorum transferri
" poffe. Inquiram pariter de fodinis Franchimontanis, quarum non nifi genera-
" lem modo notitiam habeo. De fale, qui ex his aquis elici poteft, vide, fi pla-
" cet HELMONTIUM, qui illum, fi recte memini, efurinum appellat : paucus
" omnino eft, nec credo ELICHMANNUM illo medelas fuas, ut tibi relatum eft,
" perfeciffe. Celebrabantur hic quoque ante annos viginti catapotia ex aquarum
" Spadanarum fale ; fed tandem reprehenfum eft, nihil omnino illius continere.
" Et fi tanti eft, ecce illorum compofitionem R. vitrioli martis ℥i tartari vitrio-
" lati ℥3, fucci liquiritiæ infpiffati q. s. addunt quidam fcammon. præpar. ʒij ut
" cathartica fiant ; nam, abfque eo, deobftruunt tantum, non purgant : dofis
" eft duo vel tria pifi mediocris magnitudine. Sed hæc funt alterius fori. Li-
" teris tuis refpondere decreveram, verum jam epiftolæ modum exceffi. Vale
" itaque, vir nobiliffime, meque tui femper obfervantiffimum ama, ut foles, &
" cum ad clariffimum WALLISIUM fcribes, plurimam illi nomine meo falutem
" adfcribito. Dabam Leodii 8 Feb. 1674."

Mr. HOOKE produced a quadrant of four inches diameter, with telefcopical fights, to be made ufe of by two obfervers, and diftinguifhing to minutes.

He was put in mind of his other quadrant, whereby parallaxes, refractions, &c. may be obferved in feconds by one obferver.

February 26. At a meeting of the COUNCIL were prefent

The lord vifcount BROUNCKER, prefident,

Sir JOHN LOWTHER,	Mr. HOSKYNS,
Sir WILLIAM PETTY,	Mr. HILL,
Sir CHRISTOPHER WREN,	Mr. CREED,
Mr. COLWALL,	Mr. OLDENBURG.

Mr. HOSKYNS was fworn as a member of the council.

Sir JOHN LOWTHER having made a report of the fums, which he had received, in foliciting the arrears of fome of the fellows of the Society, and taken notice, that fome had pretended, that they had been long abfent out of England ; others, that they had been drawn into the Society contrary to their inclination ; others, that they had been ignorant of the duty of weekly contributions ; he therefore defired to be inftructed what anfwer to give to fuch excufes.

6 It

It was resolved thereupon, that it should be left to the discretion of the committee, how to proceed with such persons; and that they should endeavour to get what they could of such arrears. And in the mean time it was thought adviseable to solicit those first, who were most likely to pay the whole of their arrears, and then to take part from those, who were unwilling to pay all.

It was ordered, that the council be summoned again, to meet the next day, at four in the afternoon, at Arundel House, farther to advise with the earl marshal, about soliciting the arrears of the lords, who were members of the Society; as also to consider about putting into better order and use the library, which his lordship had bestowed on the Society.

At a meeting of the Society on the same day,

Mr. Hooke shewed an experiment of the inclination of the lines of direction to the axis of the terrella; which he performed by placing a terrella in an hemispherical hole cut in a round table, and ordering the terella so, that the axis lay level with the surface of it. Upon the surface of this table was placed a large skin of parchment, stretched on a hoop like a drum head, in the middle of which was cut a circular hole, just big enough to receive the terrella. Upon this parchment were sifted fine filings of iron, which by the gentle vibration of the extended parchment soon ranged themselves into magnetical orbs, which were thought to be all of an oval figure, and of ovals of one kind, but of different bigness, and all of them to touch the axis in the center of the loadstone. But these being only conjectures, and not certainly verified, it was thought proper, in order to the clearer and more certain discovery thereof, that there should be other methods attempted to make it out; which Mr. Hooke propounded, and engaged to have at least some of them ready against the next meeting.

He observed farther, that a loadstone being moved to and fro under the parchment, on which the filings lay scattered, those filings all rose up, like so many bristles, making an appearance, as if the loadstone had been seen through the parchment.

He likewise applying a loadstone close to a small piece of tin, the stone seemed to hold it both after it was rubbed, and without rubbing.

He suggested also the making of experiments with a capped and uncapped loadstone, interposing a single paper between it and a piece of tin.

He was desired also to shew some of these experiments at the next meeting.

February 27. At a meeting of the Council at Arundel House were present

The lord bishop of Salisbury vice-president, in the chair,

The earl marshal,	Sir Paul Neile,
Sir John Lowther,	Sir William Petty,

Sir ROBERT SOUTHWELL, Mr. CREED,
Mr. HILL, Mr. OLDENBURG.

It was ordered, that Mr. EDWARD BERNARD, Savilian professor of astronomy at Oxford, having desired by Mr. HOOKE the loan of a Diogenes Laertius, and of a Coptic Psalter, out of the library bestowed upon the Society by the earl marshal, be accommodated with the said book for the space of a month, he giving bond of an hundred pounds to the Society, to restore those books at the end of the said month, to be accounted from the date of this order: and

That Mr. HOOKE take care of having the catalogue of the Arundelian library completed within a month, and to have a duplicate made thereof.

The earl marshal took a list of some of the noblemen of the Society, who were deep in arrears, as the duke of Buckingham, marquis of Dorchester, earl of Dorset, earl of Northampton, earl of Peterborough, earl of Carlisle, lord viscount Yarmouth, lord CAVENDISH, and Mr. EDWARD HOWARD.

He named upon occasion Mr. THOMSON and Mr. NELTHROP as very good men to put the four hundred pounds legacy to upon use at 6 per cent.

March 5. The president and all the vice presidents being absent, the Society did not sit; yet Mr. HOOKE repeated the magnetical experiment, which had been made at the last meeting, and which seemed to confirm that phænomenon of the magnetical orbs ranging themselves into elliptical figures.

There were also made some experiments with a loadstone, capped and uncapped, viz.

The south end of an uncapped magnet, with a single paper between it, and a small bar of steel suspended, held the said bar with four drachms and fifteen grains.

The same south end capped, without paper, held the said bar with seven ounces and one drachm.

The same south end capped, with a single paper interposed, held that bar, with one ounce, five drachms, and an half.

March 12. At a meeting of the COUNCIL were present:

The lord viscount BROUNCKER president,
The lord bishop of Salisbury, Mr. COLWALL,
Sir JOHN LOWTHER, Mr. HILL,
Sir WILLIAM PETTY, Mr. CREED,
Sir CHRISTOPHER WREN, Mr. OLDENBURG.

There was read a letter from the earl marshal to Mr. OLDENBURG, wherein his lordship proposed a method of well disposing the four hundred pounds legacy to some considerable citizens, with whom his friends had lodged considerable sums of money.

The council having debated this matter, thought proper to refer the determination thereof to another meeting of the council, ordering, in the mean time, that their hearty thanks should be given to the earl marshal for his care of the concerns of the Society.

At a meeting of the SOCIETY on the same day,

Mr. HOOKE endeavoured to shew a new way of making a loadstone set itself north and south; which was, by suspending it by a string fastened to the two ears of a cap, like the cap of a magnetical needle, which was convertible upon the sharp point of a needle. But the contrivance not proving tender enough, he was desired to fit it better for the next meeting.

He intimated a theory for finding the loadstone's variations all over the world, and promised to make an apparatus for it against the next meeting, and particularly a rete for the magnetical meridian.

The experiment about the inclination of the magnetical direction to the axis of the terrella being again made, and those lines considered, several of the members doubted whether they were ovals of one kind. Mr. HOOKE was therefore desired to contrive some method of determining this point.

Dr. GREW produced two intire microscopical observations, about the texture of a piece of a trunk of a Walnut-tree, and of one of the trunks of a hazel-tree.

Mr. OLDENBURG presented his 8th volume of the *Philosophical Transactions* for 1673.

There were also presented by Mr. OLDENBURG, from Mr. REID of Lugwarein in Herefordshire, some red-streak grafts, of which those members of the Society, who had opportunity to propagate that cider-fruit, took what quantities they had occasion for.

March 19. Mr. HOOKE gave an account of a theory for finding the variation of the magnetic needle all over the world; of which he said, that he knew not, whether it was coincident with that of Mr. HENRY BOND, who many years before had pretended to know such a theory [e]; whence he could likewise deduce the longitude.

[e] See an account of his undertakings on this subject, in the Philosoph. Transact. vol. viii. n° 95. p. 6065, for June, 1673.

The

The substance of Mr. HOOKE's theory is, that the magnet hath its peculiar pole, distant ten degrees from the pole of the earth, about which it moves; so as to make a revolution in three hundred and seventy years: whence the variation hath altered of late about ten or eleven minutes every year, and will probably so continue to do for some time, till it begins to grow slower and slower, and will at length be stationary and retrograde, and in probability may return. But whether it be so or not, or whether it proceeds in a meridian, or in a parallel or great circle, or any other irregular curve, and if in a curve, whether its concave or convex sides be towards us, more time and observations must make clear. But it seems most probable, by comparing several declinations, observed by capt. JAMES [f] and others, that the progress of this magnetical north pole is from west to east beyond the north pole.

Mr. HOOKE proposed the making of an easy and nice instrument, for observing exactly the variations of the needle in many different parts of the world; and he was desired to procure it to be made.

Mr. OLDENBURG read two letters written to him; one in Latin from CHRISTOPHER SANDIUS, dated at Hamburgh 27th February, $167\frac{3}{4}$ [g], containing the authority, which he had for asserting such an origin of pearls, as in his former letter of 15th December, 1673, he had delivered.

The other was from ANDREAS MULLERIUS at Berlin, without a date, containing an offer of an anonymous person, of furnishing a key of the Chinese language, for a recompence; and that key to be learned with great ease and expedition, even by ordinary capacities.

It was ordered, that the writer of this letter be desired to send the Society a specimen of his performance by means of his invention.

1674, *March* 26. RENATUS FRANCISCUS SLUSIUS, canon of Liege, was proposed candidate by Mr. OLDENBURG, upon a letter of his, dated $\frac{13}{23}$ March, $167\frac{3}{4}$ [h].

Signor PAeICHELLI, a Roman abbot, then at Colen, and highly commended by Mr. OLDENBURG, was proposed candidate by Mr. BOYLE.

Mr. HOOKE repeated his discourse made at the last meeting, concerning an hypothesis for solving the phænomena of all the variations of the magnetical needle all over the world; as also his purpose of preparing an easy and accurate way, to be sent abroad, for making exact magnetical observations.

He was desired to begin himself, by making good observations of the needle's

[f] Captain THOMAS JAMES, whose voyage for the discovery of a north west passage into the South Sea, was printed at London, 1633, in 4to.

[g] Letter-book, vol. vii. p. 35. It is printed in the Philosoph. Transact. vol. ix. n. 101. p. 11.

[h] Letter-book, vol. vii. p. 49.

 varia-

variation here; and, in order thereunto, to fix a certain meridian at Gresham College; which he undertook to do by the north star.

Dr. DANIEL COX's paper, concerning his way of extracting volatile salts and spirits out of vegetables, was read, and much applauded; and he being absent, it was ordered, that Mr. OLDENBURG should give him the hearty thanks of the Society; and that this discourse should not only be registred [i], but likewise forthwith printed [k].

Mr. BOYLE remarked, that to his knowledge the Dr. had been master of this way eight years before.

April 2. Mr. HOOKE shewed some experiments, concerning the various ways, that the magnetical effluvia bend and inflect themselves, by putting divers strait steel bars in the pole of the magnet, some shorter, some longer, some close to it, some at a distance, some in direction, some cross-wise; the effect whereof was, that the filings of iron being stirred by gentle knockings of the extended parchment, ranged themselves into oval or curve figures about the bars, but in a quite different form from what they would have received, had those bars of iron been loadstones of the like shape; that is, the poles seemed to lie in these, where the equinoctial would have been in a magnet, and the equinoctials of these would have been the poles of loadstones of like shape.

He promised to prosecute these experiments, by applying bodies of iron of other figures to the terrella.

He mentioned also, that whereas a loadstone would attract a red-hot iron, steel would not be at all affected by it.

Dr. GREW shewed his microscopical observations on the trunks of apple, pear, and plum-trees, and promised to bring in an account of these and his former observations.

Mr. OLDENBURG read a letter to himself from Mr. LISTER, dated 12th *March*, 167$\frac{3}{4}$ [l], giving an account of an observation of Dr. JOHNSON of Pontefract, concerning some stones of a perfect gold colour found in animals.

April 9. The Society did not meet.

April 16. The Society did not meet.

April 23. Mr. HOOKE shewed by a microscope the inward texture of a bull-rush, consisting of pipes interwoven from one end to the other, in the manner of a hurdle, or resembling loose needle-work.

[i] It is not in the Register.

[k] It is printed in the Philosoph. Transact. vol. ix. n° 101. p. 4. for March, 1674.

[l] It is printed in the Philosoph. Transact. vol. ix. n° 101, p. 9. for March, 1674.

He

He made an experiment for difcovering, whether a bar of fteel, touched by the immediate contact of a loadftone would more ftrongly move to it, than untouched. It was found, that the fteel fufpended at a balance, and counterpoifed, when thus touched, bore the fame weight when untouched.

He likewife produced a quadrant with telefcopical fights, wherein appeared the pre-eminence of fuch fights above the common dioptra's.

Mr. OLDENBURG read a letter to himfelf from Mr. HEVELIUS, dated at Dantzick, 26th March, 1674 [m], giving an account of the manufcripts of KEPLER, purchafed by the faid HEVELIUS, with a defence of the dioptræ hitherto ufed by himfelf, and alledging fome difficulties in the ufe of telefcopical fights. Further, giving notice, and fending an epitome of a new aftronomical theory, advanced by Dr. WASMUTH, profeffor of the oriental languages in the univerfity of Kilo in Holftein, who intended to publifh a book of it, with this title, *Annales Cœli & Temporum perpetui*; *five Myfteria Aftronomo-chronologica, a feculo abfcondita, nunc per Dei gratiam detecta & evidenter afferta libris tribus*. In this letter Mr. HEVELIUS defcribes a phænomenon feen by himfelf about Marienburgh in Pruffia, 5th February, 167$\frac{3}{4}$, wherein the fun appeared with a very long tail, and a mock-fun directly under him [n].

Laftly, He fignified, that the French aftronomers had obferved the fun to have no parallax at all.

To the laft part of this letter Mr. HOOKE faid, that it was defireable to know by what method the French aftronomers had made that obfervation of the fun's having no parallax at all; that he was perfuaded, that if the obfervations were made with telefcopical fights, fome, though a very fmall, parallax of the fun would be found; and that by the naked eye, be the inftruments never fo accurate, one cannot obferve to lefs than a minute; whereas that parallax will fcarce perhaps amount to a quarter of a minute.

April 30. Mr. HOOKE excufed himfelf, that his quadrant formerly promifed was not yet ready.

He made an experiment, whether an iron ring would, by any magnetical virtue, be kept in a pofture encompaffing the terrella at equal diftance. And it was found, upon making feveral effays with the faid ring, that at length it refted about the terrella unmoved, lying upon a board in water. This was tried, to fee whether any thing could be found here below analogous to the circle about the planet Saturn.

It was moved, that experiments might be made, to find,

[m] Letter-book, vol. vii. p. 71. Part of it is printed in the Philofoph. Tranfact. vol. ix. n° 102. p. 27. for April, 1674.

[n] Philofoph. Tranfact. n° 102. p. 26.

1. Whether

1. Whether all parts of the terrella have an attraction directly towards its center?

2. Whether, if there be any such attraction, that attraction be in all places of the terrella of equal strength; for instance, in the æquator as strong as in the axis?

3. Having by trials found, what the approaches of magnetical bodies to the magnet are, according to the different position of the magnet, perpendicular, horizontal, and oblique; to endeavour to find out, since the approaches are made in a curve line, what kind of curve it is?

Mr. HOOKE suggested, that the best dipping-needles may be made in water, because the water takes off the gravity; as also, that a pipe of iron should be made of equal gravity with water dipping.

Mr. OLDENBURG read a copy of a letter written to Mr. HEVELIUS by Dr. WASMUTH [o], importing, that the said Dr. rejecting all the three famous hypotheses of astronomy, had pitched upon another, of his own invention, viz. of solving all the irregularities and phænomena of the cœlestial motions by a spiral line.

Mr. HOOKE intimated, that this hypothesis was not new, the lord chancellor BACON having used it in his *Opuscula*. And Mr. OLDENBURG added, that he had found the same in the *placita Philosophica Quarini*, who had adopted and maintained the same theory.

There being many other very magnificent promises in this letter of Dr. WASMUTH, the sense of the members present seemed to be, that he had promised too much to answer expectation.

May 7, 14, 21, and 28. there was no meeting of the Society.

June 4. Mr. OLDENBURG presented to the Society four books; viz. 1. From Mr. BOYLE, intitled, *About the Excellency and Grounds of the mechanical hypothesis some Considerations proposed to a friend by* R. B. E. *Fellow of the Royal Society*, printed at London, 1674, in 4to. 2. *Navigation and Commerce, their Original and Progress; containing a succinct account of Traffick in general, its Benefits and Improvements; of Discoveries, Wars, and Conflicts at sea, from the original of Navigation to this day, with special regard to the English Nation; their several Voyages and Expeditions unto the beginning of our late Differences with Holland: in which his Majesty's title to the Dominion of the Sea, is asserted against the novel and late pretenders: by* JOHN EVELYN, Esq; F. R. S. printed at London, 1674, in 8vo. 3. *Icones & Descriptiones rariarum Plantarum Siciliæ, Melitæ, Galliæ, & Italiæ, Authore* PAULO BOCCONE, *Panormitano Siculo:* printed at Oxford, in 1674.

[o] Letter-book, vol. vii. p. 87. It is printed in the Philosoph. Transact. vol. ix. nº 104 p. 74. for June, 1674.

4. Re-

4. *Recherches & Observations Naturelles*, by the same author: printed at Amsterdam, 1674, in 8vo. With these two last books, there were presented also from the author three curious pieces of coralline substances, for the repository of the Society.

Mr. OLDENBURG read a discourse of Dr. DANIEL COXE, concerning vitriol [*], tending to discover the nature of that substance, and to give farther light in the inquiry into the principles and properties of their minerals. This discourse was highly applauded, and the author was desired to continue his experiments and observations on that subject.

Mr. HOOKE being called upon for his new astronomical quadrant, said, that he hoped, that it would be finished very soon: and being desired to acquaint the Society with the performances to be expected from this instrument, he answered,

That it was a quadrant so contrived, as to perform what could be required from any astronomical instrument; the particulars whereof he intended shortly to publish in print. He was desired to hasten the finishing of so noble and so useful an instrument; and to get it ready, if possible, against the next meeting.

He was put in mind of preparing such experiments as might determine those particulars, which were suggested by him 30th April, 1674.

June 11. The Society did not meet.

June 18. At a meeting of the COUNCIL were present

The lord viscount BROUNCKER, president,

Sir CHRISTOPHER WREN,	Mr. HILL,
Sir ROBERT SOUTHWELL,	Mr. CREED,
Mr. COLWALL,	Mr. OLDENBURG.

The president proposed, that, considering the small number of members, who attended the weekly meetings of the Society, by reason of the season of the year, wherein many go into the country, the fixed meetings be adjourned till autumn: and that in the mean time the council might sometimes meet, and consider of a better way than hitherto had been used, to provide good entertainment for the said meetings, by establishing lectures grounded upon, and tending to experiments.

At a meeting of the SOCIETY on the same day,

The Society was adjourned till the president should send out summons to return to their weekly meetings. In the mean time the council were to consider of a method of prosecuting the work of the Society with more vigour than had been done of late.

[*] It is printed in the Philos. Transact. vol. ix. n° 103. p. 41. and n° 104. p. 66.

August 27. At a meeting of the COUNCIL were present

Sir WILLIAM PETTY vice-president, in the chair,
Sir JOHN LOWTHER,
Sir JOHN CUTLER,
Sir CHRISTOPHER WREN,
Sir PAUL NEILE,
Mr. OLDENBURG.

It was considered by this council, that to make the Society prosper, good experiments must be in the first place provided, to make the weekly meetings considerable, and that the expences for making these experiments must be secured by legal subscriptions, for paying the contributions: which being done, the council might then with confidence proceed to the ejection of useless members.

September 29. At a meeting of the COUNCIL were present

Sir WILLIAM PETTY, vice-president, in the chair,
Sir ROBERT SOUTHWELL,
Dr. GODDARD,
Mr. COLWALL,
Mr. OLDENBURG.

It was ordered, that there should be prepared a form of a legal subscription, for paying fifty-two shillings a-year.

Sir WILLIAM PETTY proposed, that there might be drawn up some thing, that might effectually tend to put new vigour into the meetings of the Society, and to bring in the arrears, by representing, that the council having considered the present condition of the Society, arising from the want of good experimental entertainment at their meetings, and from the neglect of the members in paying their weekly contribution, had thought it necessary to fix a certain number of fellows, able and willing to entertain the Society every week with a considerable experimental discourse; and for the defraying of the expence necessary for the making of experiments, to appoint a solicitor to call in their arrears, and to acquaint such as are in arrears with the obligation, which they had subscribed to upon their admission, and with the Society's intention of proceeding to a legal recovery of their arrears against such, as should refuse or delay the payment thereof.

October 7. At a meeting of the COUNCIL were present

The lord viscount BROUNCKER, president,
Sir JOHN LOWTHER,
Sir WILLIAM PETTY,
Dr. GODDARD,
Mr. COLWALL,
Dr. WALTER NEEDHAM,
Dr. CREED,
Mr. OLDENBURG.

It was ordered, that as many of the fellows, as were willing to further the business of the Society, should be desired to advance a year's weekly contribution, for carrying on the work thereof with more vigour than hitherto; and that Sir WILLIAM

WILLIAM PETTY be desired to draw up a declaration to recommend the said advance accordingly:

That such of the fellows, as regard the welfare of the Society, should be desired to oblige themselves to entertain the Society, either *per se* or *per alios*, once a year at least, with a philosophical discourse grounded upon experiments made or to be made; and, in case of failure, to forfeit five pounds. And that Sir WILLIAM PETTY be likewise desired to draw up a form of such an obligation, as may bind in law: and

That Sir JOHN LOWTHER, Sir WILLIAM PETTY, and Mr. HOOKE do meet together, and consider of a safe and beneficial way of putting out the four hundred pounds, left by the late Dr. WILKINS, bishop of Chester.

Mention was made of finding out a fit person to call in the arrears, after that the meetings of the Society shall have been made more considerable by experimental entertainments: as also of thinking of a way to put Chelsea College and the land to some use.

October 15. At a meeting of the COUNCIL were present

Sir WILLIAM PETTY, vice-president, in the chair,

Dr. GODDARD,	Mr. CREED,
Mr. COLWALL,	Mr. OLDENBURG.

The two draughts of the declaration for restoring the Society, brought in by Sir WILLIAM PETTY and Dr. GODDARD were read, and the substance of both reduced into one paper, which the amanuensis was ordered to transcribe fair for farther consideration at the next meeting of the council.

It being represented, that the permitting of such, as are not of the Society, to be present at the meetings thereof, is both troublesome and prejudicial to the same, it was ordered, that the repeal of that statute, which allows such an admission, and which is the second of the fourth chapter, containing the statutes about the ordinary meetings of the Society, shall be propounded at the next meeting of the council.

It being likewise represented, that the liberty of divulging what is brought in to the meetings of the Society is also prejudicial to the same, and renders divers of the members thereof very shy of presenting to them what they have discovered, invented, or contrived; it was moved, that a form of a statute might be prepared, injoining secresy to the members of the Society in such matters, as shall be brought in, and by the president or vice-president declared to be kept secret, as the communicators desire.

A form to this end was proposed as follows:

"Every fellow of the Royal Society shall make a solemn promise before the "same, not to discover, directly or indirectly, to any person, not being of the "Society, such observations, experiments, or other communications, as shall be "brought in to the meetings of the same, and there by the president or one of the "vice-presidents declared to be kept secret, at the desire of the communica-"tor."

The time of the summoning of the Society to return to their weekly meetings being spoken of, it was resolved, that since the 29th of October [q], and the 5th of November, falling both upon a Thursday, which is the Society's meeting-day, would prove inconvenient for their meetings, the said summons should be made for the 12th of November; and to the end that the fellows might have notice what of late had been considered and done by the council in order to put life into these meetings, it was concluded upon, that the form of these summons should be as follows: viz.

"These are to give notice, that the Royal Society intends to return to their "public meetings on Thursday the 12th of November instant, 1674, in Gresham "College, at three of the clock; at which time the company will be entertained "with an experimental exercise by their president, the lord viscount BROUNCKER, "or Dr. WALLIS. The like will be performed the next meeting-day, being the "19th of November, by the honourable ROBERT BOYLE, and the 26th of the "same month by Sir WILLIAM PETTY, or, in the absence of any of them, by "Mr. ROBERT HOOKE their curator by office; in order to a vigorous prosecu-"tion of the ends of their institution; touching which the intentions of the coun-"cil of the said Society will be farther declared on the day of their anniversary "election, being the 30th of this instant November."

Memorandum: To consider of the four hundred pounds legacy, and Chelsea College, at the next meeting.

October 19. At a meeting of the COUNCIL were present

Sir WILLIAM PETTY, vice-president, in the chair,

Sir ROBERT SOUTHWELL,	Mr. COLWALL,
Dr. GODDARD,	Mr. OLDENBURG.

The business of engaging the members of the Society to enter into a legal obligation, in reference to their weekly payments, and the declaration drawn up by Sir WILLIAM PETTY and Dr. GODDARD, and the form also for summoning the Society to return to their weekly meetings being again considered of, as the main things to be determined with all possible speed; it was ordered, first, that Sir ROBERT SOUTHWELL should be desired to apply himself to the attorney-general [r], and to desire his advice in drawing up such a form, as might be binding in law:

[q] The day of the inauguration of the lord mayor of London.

[r] Sir FRANCIS NORTH, afterwards lord keeper of the great seal.

Secondly,

Secondly, That the declaration and the form of summons be likewise read again, and considered of at the next council.

Mr. HOOKE acquainted the council, that Sir JONAS MOORE had been with him at Chelsea College, and made an overture of engaging a gardiner, a sufficient man, to take a lease of the house and land about it, for a considerable number of years, on condition of repairing the house and wall in the land, and paying a yearly rent for it; allowing withal to the Society a power to make hortulan experiments there; as also to build an astronomical observatory; which latter Sir JONAS MOORE himself would undertake to do at his own charges, to the value of an hundred and fifty or two hundred pounds.

This proposition was well accepted by the council, and Mr. HOOKE was desired to prosecute the business, by urging Sir JONAS MOORE to proceed farther in this affair.

The legacy of the four hundred pounds being also again considered of, and Sir WILLIAM PETTY having made an overture of laying out that sum upon a house of the late captain GRAUNT in Birchen Lane, the council desired, that Sir JOHN LOWTHER, Sir WILLIAM PETTY, and Mr. HOOKE would meet together and ripen that business.

It was voted, that the second statute of the fourth chapter of the book of statutes be repealed; and it was repealed and made void accordingly.

October 30. At a meeting of the COUNCIL were present

The lord bishop of Salisbury, vice-president, in the chair,

Sir JOHN LOWTHER,
Mr. COLWALL,
Mr. HOSKYNS,
Mr. GODDARD,
Mr. OLDENBURG.

The form of the summons to the Society for returning to their weekly meetings being read again, it was thought fit to omit the names of the persons, who were to entertain the Society, and to let it be as follows:

"These are to give notice, that the Royal Society intends to return to their "public meetings on Thursday, being the 12th of this instant November, 1674, "in Gresham College, at three of the clock; at which time and the following "days of their meetings the company will be entertained with experimental exercises, to be performed by several eminent members of the same, in order to "a more vigorous prosecution of the ends of their institution; touching which "the intentions of the council of the said Society will be farther declared on the "day of their anniversary election, being the 30th of this instant November."

This was ordered to be forthwith committed to the press.

The form for a new subscription, drawn up by the attorney-general, was read

and approved of; and it was ordered, that Sir ROBERT SOUTHWELL be thanked for his care in procuring it, and withal desired to acquaint the attorney-general with the acknowledgments of the council for this his favour.

The declaration drawn up by Sir WILLIAM PETTY and Dr. GODDARD was read again: whereupon it was mentioned, that Sir ROBERT SOUTHWELL had taken a copy of it, in order to shew it to the lord keeper *.

Mention was again made of two propositions, one made by Sir WILLIAM PETTY, relating to the putting out of the four hundred pounds legacy; the other by Sir JONAS MOORE, concerning the letting out of Chelsea-College.

Both being well accepted of, it was thought necessary, that both the proposers should be desired to put their respective propositions in writing, that so both the businesses, to which they related, might with the more certainty and vigour be put in execution.

A memorandum of business for the next meeting:

1. About printing the form of a new subscription.

2. Sending out one to call in money.

3. Renewing the order for the treasurer's deputation.

4. What to do with the declaration.

5. To think of more entertainers of the Society.

November 9. At a meeting of the COUNCIL were present

The lord viscount BROUNCKER, president,

Sir JOHN LOWTHER,	Mr. HILL,
Sir WILLIAM PETTY,	Mr. GODDARD,
Sir ROBERT SOUTHWELL,	Mr. COLWALL,
Mr. HOSKYNS,	Mr. OLDENBURG.

The form of the new subscription was agreed upon, as follows:

"I A. B. do grant and agree to and with the president, council, "and fellows of the Royal Society of London for improving natural knowledge, "that so long as I shall continue a fellow of the said Society, I will pay to the "treasurer of the same for the time being, or to his deputy, the sum of fifty-"two shillings *per annum*, by four equal quarterly payments, at the four usual "days of payment, that is to say, the feast of the nativity of our Lord, the feast

* HENEAGE lord FINCH.

" of the annunciation of the blessed Virgin MARY, the feast of St. JOHN BAP-
" TIST, and the feast of St. MICHAEL the archangel, the first payment to be
" made upon the next ensuing the date of these presents: and
" I will pay in proportion, viz. one shilling *per* week for any lesser time, after
" any of the said days of payment, that I shall continue fellow of the said Soci-
" ety. For the true payment whereof I bind myself and my heirs in the penal
" sum of twenty pounds. In witness whereof I have hereunto put my hand and
" seal this day of in the year

" Sealed and delivered in
" the presence of

Mr. HOOKE's discourse containing *Animadversions on the first part of* Machina Cœlestis *of the deservedly famous astronomer*, JOHN HEVELIUS, &c. was licensed for the press.

N° 107 of the *Philosophical Transactions* was also licensed.

Sir ROBERT SOUTHWELL redelivered to the council the declaration, which had been drawn up for the new regulating the Society, after he had read it to the lord keeper, who, he said, well approved of it; and withal expressed his readiness to serve the Society, and particularly in doing them good offices about his majesty.

Sir ROBERT SOUTHWELL was thanked by the council, both for this care, and that other of procuring for them from the attorney general the legal form of subscription, inserted above; and he was desired, in the name of the council, to assure the lord keeper and attorney general of the deep sense, which the council had of their favour to the Society, and their regard to the welfare of the same.

Sir WILLIAM PETTY proposed in writing several ways of disposing the four hundred pounds legacy. One was the inheritance of about eighty pounds *per annum* rent in ground and houses in Hog-lane near long-alley in Moor-fields, and about eight pounds *per annum*, at Erith in Kent, which was then under mortgage for three hundred and fifty pounds, with about fifteen pounds arrears of interest. There was a claim of a dower on the premises, which might be had for under one hundred and fifty pounds.

The other way was, a house, viz. the Seven Stars in Birchin-lane, in lease to RICHARD HUTSON, who paid ninety-five pounds fine, and fifty pounds *per annum*, of which lease nineteen years and a half were then unexpired; which house was a lease of thirty-eight years yet to come; one of which a ground-rent of fourteen pounds *per annum* was to be paid.

Mr. HOOKE was desired against the next meeting of the council to view the place in Hog-lane, whether the houses were in good repair, and likely to be tenanted.

Sir

Sir WILLIAM PETTY was desired to engage Mr. BARLOW, the picture-drawer, to collect the arrears due to the Society; and that the said Sir WILLIAM, and Mr. HOSKYNS, do join in taking good security from Mr. BARLOW; and this being done, to direct him to Mr. COLWALL, the treasurer, to receive such instructions, as shall be requisite to render this business effectual, and particularly, to furnish him, under his hand, with the power of collecting the arrears in his name, according to a former order of the council, bearing date 5th January, 167¾; which order was this day renewed to the said Mr. COLWALL.

Memorandum, that at the next meeting of the council it be considered, what persons might be engaged to entertain the Society in the month of December following: And,

That those intentions of the council, mentioned in the summons of the Society to return to their meetings, were chiefly, that now there are a legal subscription and a declaration, both subscribed by the council and some other members of the Society.

It was ordered, that two hundred and fifty copies be forthwith printed of the new form of subscription, and this, if possible, against the Thursday following.

November 12. At a meeting of the COUNCIL were present

The lord viscount BROUNCKER, president,

The earl marshal,	Mr. COLWALL,
The lord bishop of Sarum,	Mr. HILL,
Sir JOHN LOWTHER,	Mr. HOSKYNS,
Sir WILLIAM PETTY,	Mr. OLDENBURG.
Sir ROBERT SOUTHWELL,	

A committee was appointed for auditing the accounts of the treasurer, consisting of the president, the two secretaries, Dr. GODDARD, and Mr. HOSKYNS: and it was left to them to meet at such time and place, as should seem most convenient to themselves.

The new form of a legal subscription for the weekly payments being again spoken of, it was thought necessary to make a statute concerning the same to this effect:

Every person continuing, or to be hereafter admitted, fellow of this Society, shall sign, seal, and, as his act and deed, deliver an obligation in the following words:

I do grant, &c. *.

It being put to the vote by the president, whether this draught now agreed

* See the form above in the minutes of the meeting of the council of November 9.

upon

upon by the council should be read at another meeting, it was unanimously carried in the affirmative.

Memorandum. 1. To inquire of Sir WILLIAM PETTY, whether he had engaged and taken security of Mr. BARLOW the collector.

2. To inquire of Mr. HOOKE, whether he had viewed the house in hog-lane.

3. To secure more persons for experimental discourses after St. Andrew's day.

4. To mention Dr. PLOT's proposal recommended by Dr. WALLIS to the council.

On the same day the SOCIETY resumed their weekly meetings [t].

Dr. WALLIS presented them with, and read before them, *a discourse of gravity and gravitation grounded on experimental observations*, and having a reference to two books not long before published by an anonymous author [u], the one intitled *an Essay concerning Gravitation or Non-Gravitation of Fluids* [x]; the other, *Difficiles Nugæ: or some Observatious touching the* Torricellian *Experiments, &c.* [y]. The doctor was thanked for this discourse, which was ordered to be entered into the Register-book [z].

It being, among other particulars in discourse upon the reading of Dr. WALLIS's paper, remarked, that the explication of the cause of springiness would contribute very much to illustrate the nature of air, Mr. HOOKE said, that he had considered that subject, and particularly to make a springy body out of a body not springy.

Mr. HOOKE was desired by the president, that if he should perform what he mentioned, he would present the Society therewith in a discourse: and being asked, whether he could promise to bring it in at the first meeting of the Society after the approaching holydays, he answered, that he would endeavour to do so.

Mr. OLDENBURG presented two small books, one in French from *Charles Drelincourt*, M. D. intitled, *La Legende du Gascon: ou la Lettre de Charles Drelincourt à Monf. Porrée sur la Methode, pretendüe nouvelle, de tailler la pierre: avec trois autres a Monf. Vallot, premier Medecin de sa Majesté*, printed at Leyden, 1674, in 12°. The other from Dr. SCHRADERUS, intitled, *Observationes de Generatione Animalium & Anatomico-medicæ.*

Mr. OLDENBURG was desired to produce Mr. LEEWENHOECK's observations concerning air, blood, &c.

[t] They met at Gresham College.

[u] Sir MATTHEW HALE, lord chief justice of the King's Bench.

[x] Printed at London in 1674, in 8vo.

[y] Printed there the same year in the same form.

[z] Vol. iv. p. 203.

November

November 19. At a meeting of the COUNCIL were present

The lord viscount BROUNCKER, president,
Sir WILLIAM PETTY, Mr. HILL,
Dr. GODDARD, Mr. OLDENBURG.
Mr. HOSKYNS,

The declaration was read, and ordered to be read again on the Monday following, November 23, for which time a meeting of the council was agreed to be summoned.

It being put to the vote, whether the draught of the bond, voted at the last meeting of the council to be read at another meeting, should pass into a law, it unanimously passed in the affirmative.

Mr. HOOKE was again desired to view the houses in Hog-lane proposed by Sir WILLIAM PETTY for laying out the four hundred pounds legacy upon, and to make a report to the council at their next meeting.

Mr. BARLOW, the designed collector, presenting himself to the council, was desired to bring in security, which he promised to do.

Persons to entertain the Society in December were pitched upon, viz. Mr. RAY, Mr. COLLINS, and Dr. SMITH; and Mr. OLDENBURG was ordered to speak or write to others concerning the business, and particularly to desire them to name their time, when they would be ready for such exercises.

Dr. ROBERT PLOT's design of making a survey of all England for compiling a history of nature and art in reference to that kingdom was well approved of; and Mr. OLDENBURG ordered to assist him in directing him to such of his correspondents in the country, as were likely to direct and instruct him in this undertaking.

Sir WILLIAM PETTY, Mr. HOSKYNS, and Mr. HOOKE, were ordered to take care of the proposal for disposing of the four hundred pounds legacy upon the houses and land in Hog lane.

It was ordered likewise, that the observations and experiments registered be sorted and reduced to several lectures, to be read at the Society upon occasion.

At a meeting of the SOCIETY on the same day,

Mr. BOYLE presented to the Society by the hands of Mr. OLDENBURG his *Experimental notes of the mechanical origin or production of fixedness, as opposite to volatility*; which discourse was read and ordered to be registered * as follows:

* Register, vol. iv. p. 234.

" The

" The qualifications, that conduce most to the fixity of a portion of matter, " seem to be these:

" First, the grossness, or the bulk, of the corpuscles it consists of; for if these " be too big, they will be too unwieldy, and unapt to be carried up in the air " by the action of such minute particles as those of the fire, and will also be " unfit to be buoyed up by the weight of the air; as we see, that vapours, " whilst they are such, are small enough to swim in the air, but can no longer " be sustained by it, when they convene into drops of rain or flakes of snow. " But here it is to be observed, that when I speak of the corpuscles, that a " fixed body consists of, I mean not either its elementary or its hypostatical " principles, as such, but only those very little masses, or clusters of particles, of " what kind soever they be, that stick so firmly to one another, as not to be " divisible and dissipable by that degree of fire, in which the body is said to be " fixed; so that each of those little concretions, though it may itself be made " up of two, three, or more, particles of a simpler nature, is considered here " *per modum unius*, or as one intire corpuscle. And this is one qualification " conducive to the fixedness of a body.

" The next is the ponderousness or solidity of the corpuscles it is made up " of; for if these be very solid, and (which solid and compact bodies usually " are) of a considerable specific gravity, they will be too heavy to be carried up " by the effluvia, or the action of the fire, and their ponderousness will make " them as unwieldy and indisposed to be elevated by such agents, as the grossness " of their bulk would make bigger corpuscles, but of a proportionably inferior " specific weight. On which account the calces of some metals as gold, silver, " &c. though by the operation of solvents, or of the air, or of both, reduced " to powders exceedingly subtil, will resist such vehement fires, as will easily " drive up bigger, but less heavy and compact, corpuscles than those calces " consists of.

" The third qualification, that conduces to the fixity of a body, belongs to " the internal parts, not barely as they are of several parts of it, but as they " are aggregated or contexed into one body: for the qualification I mean is the " ineptitude of the component corpuscles for avolation, by reason of their " branchedness, irregular figures, crookedness, or other inconvenient shape, " which intangles the particles among one another, and makes them difficult to " be extricated; by which means if one of them do ascend, others, wherewith it " is complicated, must ascend with it, and whatever be the account, on which " divers particles stick firmly together, the aggregate will be too heavy or un- " wieldy to be raised; which I therefore take notice of, because, that though usu- " ally it is on the roughness and irregularity of corpuscles, that their cohesion " depends; yet it sometimes happens, that the smoothness and flatness of their " surface make them so stick together as to resist a total divulsion; as may be " illustrated by what I have said of the cohesion of polished marbles and the plates " of glass, and by the fixity of glass itself in the fire.

"From this account of the caufes or requifites of fixity may be deduced the "following means of giving or adding fixation to a body, that was before either "volatile or lefs fixed. Thefe means may be reduced to two general heads: "firft, the action of the fire, as the parts of the body, expofed to it, are thereby "made to operate varioufly on one another: and next, the affociation of the "particles of a volatile body with thofe of fome proper additament, which term "of *proper* I rather employ, than that one would expect of *fixed*; becaufe it "will e're long appear, that, in certain cafes, fome volatile bodies may more "conduce to the fixation of other volatile bodies, than fome fixed ones do: but "thefe two inftruments of fixation being but general, I fhall propofe four or five "more particular ones. And firft, in fome cafes it may conduce to fixation, that "either by an additament, or by the operation of the fire, the parts of a body "be brought to touch each other in large portions of their furfaces: for that "from fuch a contact there will follow fuch a mutual cohefion, as will at leaft "indifpofe the touching corpufcles to fuffer a total divulfion, may appear probable "from what we lately noted of the cohefion of pieces of marble and glafs, and "from fome other phænomena, belonging to the *hiftory of firmnefs*; from which "we may properly enough borrow fome inftances, at leaft for illuftration, in the "doctrine of *fixednefs*; in regard, that ufually, though not always, the fame "things, that make a body firm, give it fome degree of fixity, by keeping it "from being diffipated by the wonted degrees of heat and agitation it meets with "in the air. But to return to the contact we were fpeaking of, I think it not "impoffible (though you may perhaps think it ftrange) that the bare operation "of the fire may, in fome cafes, procure a cohefion among the particles, (and "confequently make them more fixed) as well as in others disjoin them, and "thereby make them more volatile. For, as in fome bodies the figures and fizes "of the corpufcles may be fuch, that the action of the fire may rub or tear off "the little beards, or hooks, or other particles, that intangle them, and fo make "them more eafy for the corpufcles to be difingaged and fly upwards; fo in other "bodies the fize and fhape of the corpufcles may be fuch, that the agitation "caufed by the fire may rub them one againft the other, fo as by mutual attrition "to grind, as it were, their furfaces, and make them fo broad and fmooth, if "not alfo fo flat, as that the contact of the corpufcles fhall come to be made accord-"ing to a large portion of their fuperficies: from whence will naturally follow "a firm cohefion; which I fhall illuftrate by what we may obferve among thofe, "that grind glaffes for telefcopes and microfcopes: for thefe artificers by long "rubbing a piece of glafs againft a metaline difh or do by "this attrition at length bring the two bodies to touch one another in fo many "parts of their congruous furfaces, that they will ftick firmly to one another, "fo as fometimes to oblige the workmen to ufe violence to disjoin them. And "this inftance, (which is not the fole I could alledge) may fuffice to fhew, how "a cohefion of corpufcles may be procured by the mutual adaptation of their "congruous furfaces; and if two groffer corpufcles, or a greater number of "fmaller, be thus brought to ftick together, you will eafily believe their aggre-"gate will prove too heavy or unwieldy for avolation. And to fhew, that the "fire may effect a lævigation in the furface of fome corpufcles, I have fome-"times caufed minium, and fome other calces, that I judged convenient, to be

"melted for a competent time in a vehement fire conveniently adminiſtered; "whereby, according to expectation, that, which was before a dull and incoherent "powder, was reduced into much groſſer corpuſcles, multitudes of whoſe grains "appeared ſmooth, glittering, and almoſt ſpecular, like thoſe of fine litharge of "gold; and the maſſes, that theſe grains compoſed, were uſually ſolid enough, "and of difficult fuſion. And when I made glaſs of lead *per ſe* (which I elſewhere "teach you to do) it is plain, that the particles of the lead are reduced to a "great ſmoothneſs; ſince, whereſoever you break the glaſs, the ſurfaces produced "at the crack will not be jagged, but ſmooth, and conſiderably ſpecular: nor "do I think it impoſſible, that even when the fire doth not make any great "attrition of the corpuſcles of the body to be fixed, it may occaſion their ſtick-"ing together: becauſe by long tumbling them up and down in various man-"ners, it may at length, after multitudes of revolutions and differing occurſions, "bring thoſe of their ſurfaces together, which, by reaſon of their breadth, "ſmoothneſs, or congruity of figure, are fit for mutual coheſion; and when "once they come to ſtick, there is no neceſſity, that the ſame cauſes, that were "able to make them paſs by one another, when their contact was but according "to an inconſiderable part of their furfaces, ſhould have the ſame effect now "when their contact is full; though, perhaps, if the degree of fire were much "increaſed, a more vehement agitation would ſurmount this coheſion, and diſſi-"pate again theſe cluſters of coaleſcent corpuſcles.

"Theſe conjectures will perhaps appear leſs extravagant, if you conſider what "happens in the preparation of quick-ſilver precipitated *per ſe:* for there running "mercury, being put into a convenient ſhaped glaſs, is expoſed to a moderate fire for "a conſiderable time (for I have ſometimes found ſix or ſeven weeks to be too "ſhort an one.) In this degree of fire the parts were variouſly tumbled, and "made many of them aſcend, till convening into drops on the ſide of the glaſs, "their weight carrys them down again; but at length, after many mutual oc-"curſions, if not alſo attritions, ſome of the parts begin to ſtick together in the "form of a red powder, and then more and more mercurial particles are faſtened "to it, till at length all, or much the greateſt part, of the mercury is reduced "into the like precipitate; which, by the coheſion of the parts being grown more "fixed, will not with the ſame degree of heat be made to riſe and circulate as "the mercury would before; and yet, as I elſewhere note, I have found by trial, "that with a greater and competent degree of heat this precipitate *per ſe* would, "without the help of any volatizing additament, be eaſily reduced into running "mercury again. Chemiſts and phyſicians, who agree in ſuppoſing this precipi-"tate to be made without any additament, will, perchance, ſcarce be able to give "a more likely account of the conſiſtency and degree of *fixity*, that is contained "in the mercury; in which, ſince no body is added to it, there appears not to be "wrought any but a mechanical change. And though, I confeſs, I have not "been without ſuſpicions, that, in philoſophical ſtrictneſs, this precipitate may "not be made *per ſe*, but that ſome penetrating igneous particles, eſpecially ſaline, "may have aſſociated themſelves with the mercurial corpuſcles; yet, even upon "this ſuppoſition, it may be ſaid, that theſe particles contribute to the effect, that "is produced, but by facilitating or procuring, by their opportune interpoſition,

" the mutual cohesion of corpuscles, that would not otherwise stick to one
" another.

" Perhaps it will not be altogether impertinent to add on this occasion, that " for the generality of chemists, as well others as Helmontians, that assert the " transmutation of all metals into gold by the philosophers stone, methinks, they " may grant it to be probable, that a new and fit contexture of the parts of a " volatile body may, especially by procuring a full contact among them, very " much contribute to make them highly fixed. For, to omit what is related by " less credible authors, it is averred upon his own trial by HELMONT, who pre-" tended not to the elixir, that a grain of powder, that was given him, transmuted " a pound (if I misremember not) of running mercury, where the proportion of " the elixir to the mercury was so inconsiderable, that it cannot reasonably be " supposed, that every corpuscle of the quick-silver, that before was volatile, was " made extremely fixed merely by its coalition with a particle of the powder; " since, to make one grain suffice for this coalition, the parts, it must be divided " into, must be scarce conceivably minute; and therefore each single part not likely " to be fixed itself; or, at least, more likely to be carried up by the vehemently " agitated mercury, than to restrain that from avolation: Whereas, if we sup-" pose the elixir to have made such a commutation among the corpuscles of the " mercury, as (having made them somewhat perhaps change their figure, and " expelled some inconvenient particles) to bring them to stick to one another, ac-" cording to very great portions of their surfaces, and intangle one another, it " will not be disagreeable to the mechanical doctrine of *fixity*, that the mercury " should indure the fire, as well as gold, on the score of its new texture; which, " supposing the story true, appears to have been introduced by the new colour, " specific gravity, indissolubleness in aquafortis, and other qualities, wherein gold " differs from mercury; especially malleableness, which, according to our notes " about that quality, usually requires, that the parts, from whose union it re-" sults, be either hooked, branched, or otherwise adapted and fitted to make " them take fast hold of one another, or stick close to one another. And since " in the whole mass of the factitious gold, all, save one grain, must be materi-" ally the same body, which, before the projection was made, was quick-silver, " we may see, how great a proportion of volatile matter may, by an inconside-" rable quantity of fixing additament, acquire such a new disposition of its parts, " as to become most fixed. And, however, this instance will agree much better " with the mechanical doctrine about *fixity*, than with that vulgar opinion of the " chemists, wherewith it will not at all comply, that if in a mixture the volatile " part do much exceed the fixed, it will carry up that, or at least a good portion " thereof, with it; and on the contrary. But, though this rule holds in many " cases, where there is no peculiar indisposition to the effect that is aimed at; yet, " if the mechanical affections of the bodies be ill-suited to such a purpose, our " philosophical experiment manifestly proves, that the rules will not hold, since " so great a multitude of grains of mercury, instead of carrying up with them " one grain of the elixir, are detained by it in the strongest fire. And thus " much for the first way of fixing volatile bodies.

" The

" The second way of producing *fixity* is by expelling, breaking, or otherwise " disabling, those volatile corpuscles, that are too indisposed to be fixed them- " selves, or are fitted to carry up with them such particles, as would not without " their help ascend. That the expulsion of such parts is a proper means to make " the aggregate of those that remain more fixed, I presume, you will put me " seriously to prove; and we have a manifest instance of it in soot, where the " many active parts were, by the violence of the fire and current of the air, car- " ried up together by the more volatile parts: yet when soot is well distilled in a " retort, a competent time being given for the extricating and avolation of the " other parts, there will at the bottom remain a substance, that will not now " fly away, as it formerly did. And here let me observe, that the recess of the " fugitive corpuscles may contribute to the fixation of a body, not barely be- " cause the remaining matter is freed from so many fixed, if not also volatizing, " parts: but as it may often happen, that upon their recess the parts or inter- " vals, they left behind them, are filled up with more solid or heavy matter; " and the body becomes, as more homogeneous, so more close and compact. " And whereas I intimated, that, besides the expulsion of unfit corpuscles, they " may be otherwise disabled from hindering the fixation of the mass they belong " to; I did it, because it seems very possible, that in some cases they may, by " the action of the fire, be so broken, as with their fragments to fill up the " pores or intervals of the body they appertained to, or may make such coali- " tions with the particles of a convenient additament, as to be no impediment to " the fixity of the whole mass, though they remain in it; which possibly you " may think may well happen, when you shall have perused the instances annexed " to the fourth way of fixing bodies.

" The third means of fixing or lessening the volitility of bodies is, by preserv- " ing that rest among the parts, whose contrary is necessary to their volatilisation. " And this may be done by preventing or checking that heat or other motion, " which external agents strive to introduce into the parts of the proposed body. " But this means tending rather to hinder the actual avolation of a portion of " matter, or at most procure a temporary abatement of its volatility, than to " give it a stable fixity, I shall not any longer insist on it.

" The fourth way of producing fixity in a body is by putting to it such an " appropriated additament, whether fixed or volatile, that the corpuscles of the " body may be put among themselves, or with those of the additament, into a " complicated state or intangled contexture. This being the usual and principal " way of producing fixity, we shall dwell somewhat the longer upon it, and " give instances of several degrees of fixation: for, though they do not produce " that quality in the strictest acceptation of the word *fixity*, yet it is useful in " our present inquiry to take notice, by what means that volatility comes to be " *gradually* abated, since that may facilitate our understanding how the volatility " of a body comes to be *totally* abated, and consequently the body to be fixed.

" And first, we find, that a fixed additament, if its parts be conveniently " shaped, may easily give a degree of fixity to a very volatile body. Thus,

" spirit

"spirit of nitre, that will of itself easily enough fly away in the air, having its saline particles associated with those of fixed nitre or salt of tartar, will with the alkali compose a salt of a nitrous nature, which will endure to be melted in a crucible, without being deprived even of its spirits. And I have found, that the spirits of nitre, that abound in aquafortis, being concoagulated with the silver, they corrode, though one would not expect, that such subtile corpuscles should stick fast to so compact and solid a body as silver; yet crystal, produced by their coalition, being put into a retort, may be kept a pretty while in fusion before the metal will let go the nitrous spirits. When we poured oil of vitriol upon the calx of vitriol, though many phlegmatic and other sulphureous particles were driven away by the excited heat, yet the saline parts, that combined with the fixed ones of the colcothar, stuck fast enough to them not to be easily driven away. And if oil of vitriol be, in a due proportion, dropt upon salt of tartar, there results a tartarum vitriolatum, wherein the acid and alkalizate parts cohere so strongly, that it is not an ordinary degree of fire will be able to disjoin them: insomuch that divers chemists have (though very erroneously) thought this compounded salt to be indestructible. But a less heavy liquor than the ponderous oil of vitriol, may by an alkali be more strongly detained than that oil itself; experience having assured me, that spirit of salt being dropt to satiety upon a fixed alkali, (I used either that of nitre or of tartar) there would be made so strict an union, that having distilled the resulting salt with a strong and lasting fire, it appeared not at all considerably to be wrought upon, and was not so much as melted.

"But it is not the bare mixture or commistion of volatile particles with fixed ones (yea though the former be predominant in quantity) that will suffice to elevate the latter. For, unless the figures of the latter be congruous and fitted to fasten to the other, the volatile parts will fly away in the heat, and leave the rest as fixed as before; as when sand or ashes being wetted, or drenched with water, they quickly part with that water, without parting with any degree of their fixity: but on the other side, it is not always necessary, that the body, which is fitted to destroy, or much abate, the volatility of another substance, should be itself fixed. For, if there be a skilful or lucky coaptation of the figures of the particles of both the bodies, these particles may take such hold of one another, as to compose corpuscles, that will neither, by reason of their strict union, be divided by heat, nor by reason of their resulting grossness be elevated even by a strong fire, or at least by such a degree of heat, as would have sufficed to raise more indisposed bodies than either of the separate ingredients of mixture. This observation, if duly made out, does so much favour our doctrine, about the mechanical origin of *fixation*, and may be of such use, not only to chemists, in some of their operations, but to philosophers, in assigning the causes of divers phænomena of nature, that it may be worth while to exemplify it by some instances.

"The first whereof I shall take from an usual practice of the chemists themselves, which I the rather do, to let you see, that such known experiments are too often overlooked by them that make them; but yet may hint or confirm

"theories

" theories to those that reflect on them. The instance I here speak of, is that " which is afforded by the vulgar preparation of bezoardicum minerale. For, tho' " the rectified butter or oil of antimony, and the spirit of nitre, that are put to- " gether to make this white precipitate, are both of them distilled liquors; yet " the copious powder, that results from their union, is, by that union of vo- " latile parts, so far fixed, that after they have edulcorated it with water, they " prescribe the calcining of it in a crucible for five or six hours; which opera- " tion it could not bear, unless it had attained to a considerable fixation. This " discourse supposes, with the generality of chemists, that the addition of a due " quantity of spirit of nitre is necessary to be employed in making the bezoardi- " cum minerale; but, if it be a true observation, which is attributed to the learned " Guntherus Billichius (but which I had no furnace at hand to examine when " I heard of it) if, I say, it be true, that a bezoardicum minerale may be obtained " without spirit of nitre, barely by a slow evaporation, made in a glass-dish, of " the more fugitive parts of the oil of antimony; this instance will not indeed " be proper in this place, but yet will belong to the second of the foregoing " ways of introducing *fixity*. I proceed now to alledge other particulars in fa- " vour of the above-mentioned observation. If you take strong spirit of salt, that " when the glass is unstopt would smoak of itself in the cold air, and satiate it " with the volatile spirit of urine; the superfluous moisture being abstracted, you " will obtain by this preparation (which, you may remember, I long since com- " municated to you, and divers others virtuosi) a compounded salt, scarce, if " at all, distinguishable from sal armoniac, and which will not, as the salt it con- " sists of will do, before their coalition, easily fly up of itself into the air, but " will require a not despicable degree of fire to sublime it. Of these semi- " volatile compositions of salt I have made, and elsewhere mentioned, others, " which I shall not here repeat, but pass on to other instances pertinent to our " present design. I lately mentioned, that the volatility of the spirits of nitre " may be very much abated by bringing them to coagulate into crystals with par- " ticles of corroded silver; but I shall now add, that I guessed, and by trial " found, that these nitrous spirits may be made much more fixed by addition " of the spirit of salt; which, if it be good, will of itself smoke in the air. For " having dissolved a convenient quantity of crystals of silver in distilled water, " and precipitated them, not with a solution of salt, but the spirit of salt, the " phlegm being abstracted, and some few of the looser saline particles, though " the remaining mass were pressed with a violent fire, that kept the retort red- " hot for a good while; yet the nitrous and saline spirits would by no means be " driven away from the silver, but continued in fusion with it; and when the " mass was taken out, these spirits did so abound in it, that it had no appear- " ance of a metal, but looked rather like a thick piece of horn.

" The next instance I shall name, is afforded us by that kind of turbith, which " may be made by oil of vitriol, instead of the aquafortis employed in the com- " mon turbithum minerale. For, though oil of vitriol be a distilled liquor, and " mercury a body volatile enough, yet when we abstracted four or five parts of oil of " vitriol from one of quick-silver, (especially if the operation were repeated) and " then washed off as much as we could of the saline particle of the oil of vitriol;

" yet

"yet those that remained, adhering to the mercury, made it far more fixed than "either of the liquors had been before, and enabled it, even in a crucible, to "endure such a degree of fire, before it could be driven away, as I confess I "somewhat wondred at. The like turbith may be made with oil of sulphur per "campanam. But this is nothing to what HELMONT tells us of the operation of "his alkahest, where he affirms, that that menstruum, which is volatile enough, "being abstracted from running mercury, not only congulates it, but leaves it "fixed so, that it will endure the brunt of fires actuated by bellows, *(omnem fol-* "*lium ignem.)* If this be certain, it will not be a slender proof, that fixity may "be *mechanically* produced; and however, the argument will be good in reference "to the Helmontian Spagyrists: for if, as one would expect, there do remain "some particles of the menstruum with those of the metal, it will not be denied, "that two volatile substances may perfectly fix one another. And if, as HELMONT "seems to think, the menstruum be totally abstracted, this supposition will the more "favour the doctrine about *fixity*; since, if there be no material additament left "with the quick-silver, the fixation cannot reasonably be ascribed to any thing, "as to some new mechanical modification, and particularly to some change of "texture, introduced into the mercury itself.

"And that you may think this the less improbable, I will now proceed to some "instances, whereof the first shall be this, that having put a mixture, made of "two dry, as well as volatile bodies (usually enough employed by spagyrists) to "half its weight of common running mercury, and elevated its mixture three "or four times from it, the mercury, that lay in the bottom, in the form of a pon-"derous and somewhat purplish powder, was by this operation so fixed, that it "long endured a strong fire, which at length was made so strong, that it melted "the glass, and kept it melted, without being strong enough to force out the "mercury; which, by some trials, not so proper to be here mentioned, seemed "to have its salivating and emetic powers extraordinarily infringed. But this "only upon the by: in all the other instances (wherewith I shall conclude these "notes) I shall employ one menstruum, oil of vitriol, and shew you the efficacy "of it, in fixing some parts of volatile bodies with some parts of itself; by which "examples it may appear, that a volatile body may not only lessen the volati-"lity of another body, (as in the lately mentioned case of our spirituous sal armo-"niac) but that two substances, that apart were volatile, may compose a third, "that will not only be less volatile, but considerably (if not altogether) fixt.

"We mixed then by degrees about equal parts of oil of vitriol and oil of tur-"pentine; and though each of them single, especially the latter, will ascend "with a moderate fire in a sand furnace, yet after the distillation was ended, we "had a considerable quantity, sometimes (if I misremember not) a fifth or sixth "part, of a caput mortuum, black as a coal, and whereof a great part was of a "scarce to be expected fixedness in the fire.

"To give a higher proof of the disposition, that oil of vitriol has, to let some "of its parts grow fixed by combination with those of an exceeding volatile ad-"ditament, I mixed this liquor with an equal or double weight of highly recti-

"fied

" fied ſpirit of wine, and not only after, but ſometimes without, previous di-
" geſtion, I found, that the fluid parts of the mixture being totally abſtracted,
" there would remain a pretty quantity of a black ſubſtance ſo fixed, as to afford
" juſt cauſe of wonder.

" And becauſe camphire is eſteemed the moſt fugitive of conſiſtent bodies, in
" regard that, being but laid in the free air, without any help of the fire, it will
" fly all away; I tried, what oil of vitriol, abſtracted from camphire, would do,
" and found at the bottom of the retort a greater quantity, than one would ex-
" pect, of a ſubſtance as black as pitch, and almoſt as far from the volatility
" as from the colour of camphire; though it appeared not, that any of the
" gum had ſublimed into the neck of the retort.

" From all which inſtances it ſeems manifeſtly enough to follow, that in
" many caſes there need nothing to make aſſociated particles, whether volatile or
" not, become fixed, but either to implicate or intangle them among themſelves;
" or bring them to touch one another, according to large portions of their ſur-
" faces; or by both theſe ways conjointly, or by ſome others, to procure the firm
" coheſion of ſo many particles, that the reſulting corpuſcles be too big or
" heavy, to be by the degree of fire, wherein they are ſaid to be fixed, driven up
" into the air."

It was propoſed, as convenient, that ſeeing it was not to be expected, that the members would preſently, upon hearing of ſuch diſcourſes as theſe give their thoughts of them, it would be proper to do it at the next meeting, after the reading of another lecture.

A committee was appointed for auditing the treaſurer's accounts, conſiſting of Mr. Aerskine, Dr. Whistler, Dr. Smith, Mr. Hooke, and Mr. Collins.

Mr. Oldenburg read a letter to himſelf from Dr. Swammerdam, dated at Amſterdam, 9th October, 1674 [b], containing a deſcription and draught of a rupture of a meſentery, a rare caſe.

Mr. Henshaw preſented the Society with ſeveral curioſities, which he had brought with him out of Denmark: viz.

1. A great piece of foſſil amber, found in the fortifying of Ranſburg in Holſtein, above ſix Engliſh yards under the earth, the place being twenty-five Engliſh miles from the Baltic, and above thirty-ſix Engliſh miles from the German ſea; which ſea alſo does not flow within twenty-one Engliſh miles of that town, as was atteſted by a letter written 7th December, 1672, by Mr. Odman, an eye-witneſs of the taking up of this amber.

[b] Letter-book, vol. vii. p. 108. It is printed in the Philoſ. Tranſact. vol. x. nº 112. p. 273. for March, 1675.

2. An *Alga Saccharifera*, of which OLAUS BORRICHIUS by his own hand writes thus: "Alga Saccharifera nascitur in mari Islandico non procul a littore, "ejiciturque in littus, per tempestates, ubi simul ac emerserit e mari, salsedinem "linguæ offert. Sed ubi aliquandiu in littore recubuit, sensim salsus ille sapor "illi ab aqua marina perit, ejusque loco pedetentim operitur alba "quadam veluti farina, quæ Saccharum dulcedine & colore imitatur, usurpaturque incolis Sacchari loco. Mihi allata quæ fuit ex Islandia, sapore & farina "illa adventitia diu carebat; sed tandem in fenestra aliquandiu quasi neglecta ja-"cens eodem modo farina Saccharina cooperta fuit, maxime inferiori."

3. *Scarabæus Islandicus, qui adhæret, teste eodem* BORRICHIO, *certo generi Asellorum piscium in mari Islandico, quod genus Asellorum Danis appellatur* KUTLER. One of these being opened, it was found filled up with a gummous reddish substance, some part transparent, into which all the inner parts of this insect seemed to have been converted.

4. A black substance, which seemed to be wood turned into jett, dug out of the ground in Denmark.

5. A piece of Iceland crystal (as it is vulgarly called) having a double refraction.

6. Some figured Icelandic stones.

7. Some pieces of silver, said to be dug out of the mines of Norway.

8. Some white amber.

Mr. HENSHAW shewed also a very fine horn of a young horn-fish, not hollow; as likewise three pieces of fine amber, two whereof had insects inclosed in them, the third a moveable bubble, which, he said, would in a frost congeal and become immoveable, and upon a thaw, or being put in a warm place, become moveable again.

Mr. OLDENBURG presented to the Society three books: 1. Dr. WALLIS's *Grammatica Linguæ Anglicanæ* augmented. 2. ERASMI BARTHOLINI *selecta Geometrica:* printed at Copenhagen in 1674, in 4to. 3. DAVIDIS VONDER BECK, *Mindani, Experimenta & Meditationes circa Naturalium Rerum principia:* printed at Hamburg, 1674, in 8vo, and dedicated to the Royal Society.

November 23. At a meeting of the COUNCIL were present

The lord viscount BROUNCKER, president,

The lord bishop of Salisbury,	Mr. COLWALL,
Sir JOHN LOWTHER,	Mr. HOSKYNS,
Sir WILLIAM PETTY,	Mr. HILL,
Dr. GODDARD,	Mr. OLDENBURG.

It

It was ordered, that the declaration, with the form of the new bond annexed to it, be put to the preſs, ſo that a proof of it might be ready for the next meeting of the council: and

That Mr. Barlow be taken for collector of the arrears, after he had given a bond of his own of one hundred pounds for ſecurity, and that he be allowed twelve pence in the pound: and that this be declared to him by the preſident, in the name of the council: which was done accordingly.

The members of the council, who were preſent, ſealed the new bond.

Mr. Hooke being called upon to make a report of the view, which he had been deſired to make, of the houſes and lands in Hog Lane, propoſed by Sir William Petty for employing the four hundred pounds legacy; and he not having yet taken that view, was deſired again to do it againſt the next meeting of the council.

Memorandum. That thoſe, who were at the council, ſubſcribed the new obligation for paying fifty two ſhillings a-year, but with this reſerve, that in caſe the number of the ſubſcribers ſhould not amount to fifty, between that time and Lady day following, thoſe, who had actually ſubſcribed, ſhould be free from the ſaid obligation.

November 26. At a meeting of the council were preſent

The lord viſcount Brouncker, preſident,

The lord biſhop of Saliſbury.	Mr. Colwall,
Sir John Lowther,	Mr. Hoskyns,
Sir William Petty,	Mr. Hill,
Sir Robert Southwell,	Mr. Oldenburg.
Dr. Goddard,	

The committee of the council for auditing the accounts made their report, which was approved of.

Mr. Hooke gave the council ſome account of the houſes and lands in Hog Lane, propoſed by Sir William Petty, the conſideration whereof was referred to another meeting.

A proof of the declaration being ready, it was read again, and after ſome alterations ordered to be printed off, to the number of two hundred and twenty-five copies, to be committed to the cuſtody of the preſident.

At a meeting of the Society on the ſame day,

Mr. Henry Jenkes, profeſſor of rhetoric at Greſham College, was propoſed candidate by Mr. Hill.

Sir WILLIAM PETTY presented to the Society his discourse concerning the importance and usefulness to human life of the consideration of duplicate and subduplicate proportion: which discourse was read and ordered to be registered [c], and printed [d].

This discourse was made out by the following instances, viz.

1. In the drawing or driving powers, which force ships or other bodies through the water, with reference to the respective velocities caused thereby.

2. In the shapes or sharpness of bodies, cutting or dividing the water, through which they are driven or drawn, and in the different velocities arising from thence, where the bodies and forces are equal.

3. In the strength of timbers, or other heterogeneous materials applied to buildings, to carts, or to any other machinaments intended for strength; and how by a model to judge of the sufficiency of such engine as is represented by it.

4. In the effect of oars upon equal and alike vessels, according to their numbers, length, blades, and motions with or against the stream or on even waters.

5. In the motion or travelling of horses on their several paces, and with different burthens on them.

6. In the strength and velocity of mills and their wheels.

7. In the effects of gun-powder.

8. In the distances at which sounds may be heard.

9. In the distances at which odoriferous matters may be smelt.

10. In the distances at which the objects of sight may be seen.

11. In the time of the returns made by vibrating pendulums.

12. In the lives of men and their duration.

13. In musical and sounding bodies, such as strings and bells.

14. In the effects and motions of fire and burning spirits.

15. In the rising and falling of bodies, but especially of water in pumps, over-shot mills, leaks in ships, the hights of rivers at their head above their fall into the sea.

16. In bellows.

[c] Register, vol. iv. p 246.

[d] It was printed at London, 1674, in 12°. A censure of it is published in the *Genuine Remains* of Dr. THOMAS BARLOW, bishop of Lincoln, p. 151. Edit. London, 1693, in 8vo.

17. In the prices of ſeveral commodities, as maſts, diamonds, large timber, amber, load-ſtones, &c.

18. In mill-dams, ſea-brooks, and the bulwarks or walls of fortreſſes.

19. In the compreſſion of wool, and other elaſtic bodies, and of the air within diving veſſels; as alſo in the effects of ſcrew-preſſes upon ſeveral materials.

The appendix contains a new hypotheſis of ſpringing or elaſtic motions.

It was ordered, that an apparatus be made for trying experiments about ſpringineſs.

November 30. Mr. JENKES was elected.

Sir JONAS MOORE was propoſed candidate by the preſident.

The committee of the Society for auditing the accounts made their report, as follows:

" The committee of the Royal Society for auditing the treaſurer's accounts, " November 26, 1674,

" We find Mr. DANIEL COLWALL debtor,

	l.	s.	d.
" To monies he hath received on the ſeveral quarterly payments of " the Society from 13 Novemb. 1673, to 19 Novemb. 1674,	190	6	6
" To monies he hath received for admiſſions - - - - -	15	3	0
" To balance of his account of November 13th, 1673, - -	5	12	1
" To money more by a legacy of the late lord biſhop of Cheſter	400	0	0
	£609	1	7

" We alſo find he is creditor,			
" By monies he hath paid for the uſe of the Society by order	183	5	0
" By balance reſting in caſh in his hands - - - - -	25	16	5
" And by money paid into the caſh cheſt of the Society - -	400	0	0
	£609	1	7

This done, the Society, at which forty-two members were preſent, proceeded to the election of a new council and officers.

Of the old council were continued

The lord viſcount BROUNCKER,
The earl marſhal,
The lord biſhop of Saliſbury,
Sir JOHN LOWTHER,

Sir

Sir WILLIAM PETTY,	Mr. HOSKYNS,
Sir ROBERT SOUTHWELL,	Mr. HILL,
Dr. GODDARD,	Mr. OLDENBURG.
Mr. COLWALL,	

The ten new members of the council were

The earl of Aylefbury,	Mr. HENSHAW,
Sir JOSEPH WILLIAMSON,	Mr. PEPYS,
Sir JAMES SHAEN,	Dr. WHISTLER,
Sir JOHN LAURENCE,	Mr. SMITH,
Sir JOHN BANKES,	Dr. DANIEL COX.

The officers elected were

The lord vifcount BROUNCKER, prefident,
Mr. COLWALL, treafurer,
Mr. HILL, } fecretaries.
Mr. OLDENBURG, }

Of the ten new members of the council were fworn thefe three only, Sir JAMES SHAEN, Mr. PEPYS, and Dr. WHISTLER; the reft being abfent.

December 3. At a meeting of the COUNCIL were prefent.

The lord vifcount BROUNCKER, prefident,

The lord bifhop of Salifbury,	Dr. GODDARD,
Sir JOHN LOWTHER,	Dr. WHISTLER,
Sir WILLIAM PETTY,	Mr. COLWALL,
Sir ROBERT SOUTHWELL,	Mr. OLDENBURG.

It was refolved, that every member of the prefent council fhall provide an experimental difcourfe for the Society to be made at fome one public meeting within the year, either by himfelf or by fome other member of the Society; or to pay forty fhillings.

It was ordered, that Mr. OLDENBURG be defired to offer the new legal obligation for paying fifty-two fhillings a year for the ufe of the Royal Society, to as many members of the fame to fign and feal, as conveniently he can; and likewife fhew them the ftatute made by the council to engage every fellow of the Society to fuch a fubfcription:

That there be forthwith made a catalogue of all the prefents made by feveral perfons to the Society; together with the names of the donors; and that duplicates thereof be made, the one to be kept by the keeper of the repofitory, and the other by the treafurer *pro tempore*:

5 That

That a catalogue be made of all the inftruments or other apparatus of the Society, paid for out of the public treafury; and that the inftruments be looked out and kept together in the repofitory for inftruments:

That a table and catalogue be made of all the books, difcourfes, letters, and accounts, brought into the Society; together with the names of the authors: and that all the faid books, difcourfes, letters, and accounts, be kept in convenient preffes under locks and keys, and that the prefident and fecretaries *pro tempore* have the keeping of the faid keys: And,

That Mr. AUBREY and Mr. COLLINS be defired to be affifting in this bufinefs, and to make propofals at the next meeting of the council on that day fe'nnight, what they would expect for their affiftance.

Memorandum, that it was propounded by Sir WILLIAM PETTY, that all the difcourfes entered into the Society's Regifter-books fhould be divided into feveral fections and chapters; and that this fhould be taken into confideration at the next meeting of the council.

At a meeting of the SOCIETY on the fame day.

Sir JONAS MOORE was elected and admitted.

Sir PAUL WHICHCOTE, Bart. was propofed candidate by Dr. BROWN.

Mr. HOOKE read his difcourfe concerning the conftruction and ufes of his new quadrant for making remote obfervations with great exactnefs.

He was defired to have this inftrument perfected; and for trying the performance of it, the lord bifhop of Salifbury, Sir WILLIAM PETTY, Sir CHRISTOPHER WREN, and Sir JONAS MOORE, were defired to meet as a committee on the Tuefday following in the afternoon for that purpofe.

Monf. LEYENBERGH, envoy extraordinary from the king of Sweden, fent a paper containing a lift of fome pretended new mechanical and geographical inventions by one ANDREW ALEXANDER, a German, viz.

1. *Anemometrum, h. e. inftrumentum ad vires venti quovis tempore terra marique metiendas.*

2. *Machina tranfportatrix univerfalis ad res graves particulatim facili opera & continuatione furfum vel deorfum, vel etiam via horizontali transferendas; cujus ufus potiffimum architectura civili et militari nemque ad machinas hydraulicas.*

3. *Structura caminorum noviter inventa, qui optime fumum trahant; itemque correctio caminorum fumantium.*

4. *Supple-*

4. *Supplementum geographicum ad usum mapparum longe expeditiorem; res quidem magni laboris, sed amplissimæ perpetuæque utilitatis, hactenus a nemine tentata.*

5. *Cogitata super præcipuo rei nauticæ problemate de inveniendis per mare longitudinibus sive meridianis, sub quibus navis versetur.*

Sir JOSEPH WILLIAMSON, who said he knew this person, and Sir WILLIAM PETTY were desired, at their conveniency, to examine him about these particulars.

Sir JOHN LAWRENCE, Sir JOHN BANKES, and Mr. HENSHAW, were sworn as members of the council.

December 10. At a meeting of the COUNCIL were present

The lord viscount BROUNCKER, president,

The lord bishop of Sarum,	Mr. COLWALL,
Sir WILLIAM PETTY,	Mr. HILL,
Mr. HENSHAW,	Mr. OLDENBURG.
Dr. GODDARD,	

It was ordered, that the Society having desired Sir WILLIAM PETTY to print his discourse made before them on the 26th of November last, it be printed by the printer to the Society.

The council having formerly charged themselves to provide each of them an experimental discourse for the Society at some one meeting within the year, it was resolved, that a letter should be written by the secretary, and signed by the president, to the fellows of the Society hereafter named, to desire them to provide the like discourses, and to name the day after the 14th of January next, when to bring them in.

The said fellows were

Sir CHRISTOPHER WREN,	Dr. SMITH,
Mr. EVELYN,	Dr. VOSSIUS,
Dr HOLDER,	Mr. WYLDE,
Dr. CROUNE,	Mr. BERNARD,
Dr. WALTER NEEDHAM,	Dr. KING,
Dr. BROWN,	Mr. COLLINS.
Dr. POPE,	

The council nominated also those persons, to whom application should be made for signing the new bond, viz.

The earl of Anglesey,	The earl of Shaftesbury,
The earl of Strafford,	The lord bishop of Chester,
The earl of Devonshire,	The lord BRERETON,

Sir

Sir Charles Berkley,
Sir Kingsmill Lucy,
Sir Gilbert Talbot,
Mr. Thomas Howard,
Mr. John Stafford Howard,
Mr. John Williams,
Dr. Tillotson,
Mr. Barrington,
Mr. Slingesby,
Mr. Neile,
Dr. Glisson,
Dr. Thomas Cox,
Mr. Thomas Cox,
Mr. Locke,
Mr. Packer,
Mr. Wylde.

At a meeting of the Society on the same day,

Daniel Miller, B. D. was proposed candidate by the president.

Dr. Grew presented and read his *discourse concerning the nature, causes, and power of mixture*; which was ordered to be registered *.

Several of the experiments mentioned in this discourse were exhibited after it was read.

December 17. At a meeting of the Council were present

The lord viscount Brouncker, president;
The lord bishop of Salisbury,
Sir John Lowther,
Sir James Shaen,
Sir Joan Bankes,
Sir William Petty,
Mr. Henshaw,
Mr. Pepys,
Dr. Goddard,
Dr. Whistler,
Mr. Colwall,
Mr. Oldenburg.

Dr. Cox having promised to entertain the Society on the 7th of January, Mr. Hooke undertook to do the like on the 14th of that month.

Sir John Lowther, Sir John Bankes, Mr. Pepys, and Dr. Goddard, were appointed a committee to consider, whether the four hundred pounds legacy might not be best laid out upon fee-farm rents: and they were desired to ripen this business for the 17th of January, and make their report to the council.

The president, Sir Robert Southwell, and Mr. Pepys, were desired to make application to his highness prince Rupert, concerning the mischief, which his glass-house does to Chelsea-college; and to suggest to the prince, that his highness may perhaps put it and the land to some good uses, if he pleases to take it to himself, and to consider the Society for it.

It was resolved, that Sir Jonas Moore be desired to write a letter to the prince, and to acquaint him, that the house and land of Chelsea might have been well

* Register-book, vol. iv. p 271. It is printed in his *Anatomy of Plants*, b. iv. London, 1682, in folio.

difpofed of for the benefit of the Society, if it had not been for the annoyance of the neighbouring glafs-houfe.

The form of the letter drawn up by Mr. Oldenburg to be written to divers members of the Society, to defire them to provide difcourfes for the public meetings, was reported by Mr. Oldenburg to have been viewed and altered by the prefident, and by his lordfhip ordered to be thus iffued:

"Sir,

"The council of the Royal Society confidering with themfelves the great importance of having the public meetings of the faid Society conftantly provided with entertainments fuitable to the defign of their inftitution, have thought fit to undertake to contribute each of them one; not doubting but that many of the fellows of the Society will join with them in carrying on fuch an undertaking. And well perfuaded of your approbation of this their purpofe, fo much tending to the reputation and fupport of the Society, they defire, that you would be pleafed to undertake for one, and to name any Thurfday after the 14th of January next, fuch as fhall be moft convenient for you, when you will prefent the Society at one of their faid public meetings by yourfelf, or fome other of the fellows for you, with fuch a difcourfe, grounded upon or leading to philofophical experiments, on a fubject of your own choice. In doing of which you will benefit the Society, and oblige,

"Sir,

"Your humble fervant,

"Brouncker, P. R. S."

Mr. Hooke having propofed to the council, that in order to the bringing in of feveral fets of experiments, that would require an apparatus of inftruments for the making of them, fuch inftruments might be ordered to be prepared, whilft he was drawing up fuch experiments; the council refolved, that the fets of experiments fhould be firft brought in before them; and that then they would confider of and give order for fuch inftruments, as fhould be neceffary for exhibiting the fame.

The council farther defiring Mr. Hooke to name a fet of experiments to begin with, he named thofe of the magnet.

At a meeting of the Society on the fame day,

Mr. Ray's two difcourfes, one on *the feeds of plants*, and another on *the fpecific differences of plants*, were prefented from him by Mr. Oldenburg; and read, and ordered to be regiftered [f]; and were as follows:

"A difcourfe on the feeds of plants.

"Nature obferves not proportion of magnitude between feeds and the plants,

[f] Regifter, vol. iv. p. 285, and 294.

"that

" that come of them; I mean so, as that the greater seed should produce the " greater plant, and the lesser seed the lesser plant: for the seeds of several trees " are much less than the seeds of many herbs: as for example, the seeds of elm, " poplar, willow, birch, alder, than the seeds of beans, pease, lupines, and all " kinds of pulse, pumpions, melons, and all kind of pomiferous herbs, not to " mention infinite others. This holds true, not only in plants of different kinds, " but even in those of the same, as I have observed in oaks; the scarlet oak, " which seldom rises higher than a small shrub, bearing an acorn as big as our " English oak: and in honey-wort, the purple annual kind bearing a seed twice " as big as the great perennial mountain kind. The like difference may be ob- " served between the seeds of mustard and charlock, several sorts of lotus, and " many others.

" Neither indeed in oviparous animals doth nature always observe the same " proportion of magnitude between the eggs, that is, between the animals, al- " though of the same tribe or genus: for, though lobsters or crayfish be so like " one to the other, that one can find little difference between them, save only in " magnitude; yet are the eggs of the crayfish, which is the lesser, bigger than " those of the lobster, which is the greater: and, in whole-footed birds, the eggs " of the duffin, auk, and guillemot (which lay but one egg at a time) are as " much bigger than ducks eggs, as the birds themselves are less than ducks.

" Though in some plants, which run much by the root or wire, or that pro- " pagate themselves by off-sets, it be true, which some have observed, that they " seldom bring their seed to maturity, as if nature, intent upon those ways of pro- " pagation, did neglect that by the seed: such plants are colocasia, horse-radish, " periwinkle, Jerusalem-artichoke; though, I say, this held true in some, yet " is it far from a general rule; there being many plants, which abundantly pro- " pagate themselves by the root or wire, and yet yield plentiful ripe seed too, " as goutwort, mint, strawberry, &c. But on the other side, I think, it may " pass for a general truth, that plants, which bring little seed to maturity, do " abundantly spread or multiply themselves some other ways; else nature might " seem to be wanting in means for the conservation of such species.

" The lesser seeds are the most fertile; such plants as bear the least seed bringing " the greatest plenty or abundance: as, for example, tobacco, which, for a plant " of that bigness, bears the least seed of any I know, producing the greatest " number of seeds; Laurembergius counting from one plant an encrease of " three hundred and sixty thousand.

" Among the seeds of herbs I have observed, that the greatest of all are such " as come of annual plants, to wit, beans, pease, lupines, maiz, or Turkey- " wheat, &c. In these kinds (of pulse and grasses) the annual (though sometimes " less plants) have greater seeds than the perennials; as for instance, the com- " mon pease than the everlasting pease; but always, I think, it happens so in " these kinds, if the plants be of equal bigness, that the seeds of the annual " are larger than the seeds of the perennial.

" It is worth the noting, that all thoſe ſeeds, that are uſed by mankind for food, " are ſeeds of annual plants, viz. wheat, rye, ſpelt, maiz, rice, barley, oats, mil- " let, panic, ſorgum; and of pulſe, beans, peaſe, lupines, kidney-beans, vetches, " lentils: the reaſon whereof, I ſuppoſe, is no other, than becauſe they are in their " kinds the greater, and have the more pulp. For I doubt not but many peren- " nial graſſes bear eſculent ſeed, as well as theſe annual ones, which we call " corns; and I believe ſome perennial pulſe too, though none ſo large as theſe " annual ones we uſe.

" The greateſt number of plants, that come of ſeed, ſpring at firſt out of the " earth with two leaves, which being for the moſt part of a different figure from " the ſucceeding leaves, are by our gardeners not improperly called the ſeed- " leaves.

" Theſe ſeed-leaves are for the moſt part entire or undivided, even in thoſe " plants, whoſe after-leaves are moſt finely or minutely diſſected, as in the um- " belliferous kind. For the moſt part, I ſay, for in ſome few they are indented; " as in radiſh with one indenture, in Indian-creſſe with two. In garden-creſſe " each ſeed leaf is divided into three ſegments.

" The ſeed-leaves are for the moſt part ſmooth, even in thoſe, whoſe after-leaves " are rough or hairy. In ſome few, as for example, the Roman nettle, and I " believe all other nettles, the ſeed-leaves alſo are rough.

" In all thoſe plants, which ſpring up with two-ſeed leaves, the whole pulp or " content of the ſeed is nothing elſe but the young plant perfectly formed, ma- " ture, and ready for excluſion: ſo that, if you carefully take off the teguments " of the ſeed, either while yet green, or well ſteeped when ripe, you may clearly " ſee and diſtinguiſh all the parts of the included plant, viz. the radicle or ger- " men of the root, and two ſeed-leaves in all, and in ſome the rudiment of the " ſtem and plant-leaves beſides, as in the common bean and kidney-bean: in " this laſt, the two firſt plant-leaves being perfectly formed.

" In the ſeeds of theſe plants, when mature, I could never obſerve any co- " heſion between the teguments and the included plant.

" Thoſe ſeeds, whoſe pulp is nothing elſe but the included plant, are of two " ſorts. 1. In ſome the two ſeed-leaves lie plain, ſmooth, and extended, with- " out plait or fold. 2. In others, the two ſeed-leaves, together with the ra- " dicle, are variouſly folded up.

" In the firſt kind, the ſeed-leaves are nothing but the two lobes of the ſeed " having their plain ſides clapt together, like the two halfs of a walnut; and " therefore are of the juſt figure of the ſeed, ſlit in ſunder flat-wiſe, as in pum- " pion and melon ſeeds, and many others.

" In

"In these, though the whole pulp seems to be compounded of two lobes, yet "to him, that carefully views and examines it, the radicle also will easily appear, "inserted into each lobe, and connecting both together like a couple or hinge.

"This union of the radicle to the lobes is either, first, at that end of the seed, "which coheres to the fruit or seed-vessel, as in apple and pear kernels, sun-flower "seed, melon and pumpion seed, and abundance more: or, 2dly, At a distance "from the place of cohesion, as in beans, lupines, and all sorts of pulse, &c. "or, 3dly, At the quite contrary ends, as in borage, bugloss, and others of that "family.

"In such, whose radicle is at either extreme, I have observed it to be at the "sharper or more pointed one; so that if the sharper end of the seed be that, which "coheres to the seed-vessels, the radicle is always at that end, as in apple or pear "kernels, and the rest before instanced in: but if the sharper extreme be the "tip of the seed, or the end just opposite to the place of cohesion, the radicle "shall be at that end, as in acorns, almonds, &c. In both these kinds, the ra-"dicle must needs be short.

"In such seeds, wherein the connexion of the lobes is at a distance from the "place of cohesion, but not at the just opposite part or end, the radicle is longer "than in the two former kinds, and runs bending along the verge of the lobes, "till the the tip of it comes to point at the place of cohesion.

"This observation may be of some advantage in setting, at least the larger sort "of seeds; for it will certainly somewhat promote the springing of the seeds, so "to set them, that the point of the radicle may be downwards, or at least so as "they naturally lie, when fallen from their plants upon maturity. And it must "needs hinder their growth, to set the point of the radicle just upwards, the ra-"dicle in such a case being forced to bend two right angles, or a whole semicircle, "before it come to run directly down again; and likewise, on the contrary side, "the stem to turn as much before it can mount up; so that the sap will have a "double reflection before it get out of the root into the stalk.

"In the second kind, that is those seeds, wherein the seed-leaves and radicle lie "folded up, the pulp of the seed cannot properly be said to be divided into two "lobes.

"In these the complication of the leaves and radicle is very different. In the "radish, turnep, and, I believe, all that come up with such a fashioned leaf, the "young plant is most elegantly folded up into a globular figure, viz. the seed-"leaves being clapt together, as in all others, first the radicle is turned up upon "them; then the two sides of the seed-leaves are turned over the radicle, one "one way, the other the contrary, so embracing it. In the seed of the syca-"more-tree, the two seed-leaves clapt together as before are first bent backwards "upon themselves, and then with the radicle rolled up into a round roll, as if "one should double a short and narrow ribband or thong of leather twice, and

"then

T

" then roll it up. In the garden creſſe, the two lateral ſegments of each ſeed-
" leaf being laid cloſe on the back of the main, or end ſegment (as being toge-
" ther of the juſt breadth of it) the ſaid end ſegments clapt together are ſo in-
" cloſed in the teguments; the radicle being not turned up immediately upon the
" ſeed-leaves, but as it were firſt lying at length involved in the teguments, and
" ſo turned up upon the ſeed-leaves; as if one ſhould double or bend the ſeed
" together after it was incloſed in its coats; as may be evidently ſeen by any
" one, that will but take the pains carefully to view and heed the ſeed. The like
" bending or doubling together of the ſeed I have obſerved in *dames violet*. Be-
" ſides theſe, many other different ways there are of making up ſeeds in their
" teguments, which it would be tedious to deſcribe, and difficult to underſtand,
" unleſs illuſtrated by figures: only I cannot but take notice, that though the
" maple be a congenerous tree to the ſycamore, yet is the young plant in the ſeed
" differently folded up from that of the ſycamore in its ſeed.

" Of ſeeds, that ſpring out of the earth with leaves like the *ſucceeding*, and no
" ſeed-leaves, I have obſerved two ſorts. 1. Such as are congenerous to the firſt
" kind precedent; that is, whoſe pulp is divided into two lobes and a radicle.
" The only difference between them is, that theſe bring not up their lobes above
" ground in form of leaves, as the other do, though I doubt not but the lobes of
" the ſeed have the ſame uſe in theſe as in thoſe that bring them up. For in
" the ſame family of plants, ſome ſeeds bring up their lobes above ground, others
" do not, as in the legumina or pulſe kind, the common bean brings them not up,
" the kidney-bean doth; the peaſe again doth not, the lupine doth.

" 2. Such, which neither ſpring out of the ground with ſeed-leaves, nor have
" their pulp divided into lobes; of theſe I have obſerved two kinds. 1. Such,
" in which the included plane is but a ſmall part of the pulp of the ſeed; (in
" thoſe I have hitherto obſerved I think ſcarce a tenth.) 2. Such, in which the
" whole pulp is nothing elſe but the included plant. Of the firſt kind I have
" obſerved two ſorts: 1. Such, in which the young plant ſticks to that end of
" the ſeed, which grows to the ſeed-veſſel or mother-plant, in form almoſt of a
" bud, together with its ſcutcheon, clapt to the body or branch of a tree in
" inoculation. 2. Such, in which the embryon-plant is incloſed in the middle of
" the ſeed, as it were a pith or kernel.

" Of the firſt ſort are all corns; I mean cerealia, as contradiſtinct to legumina,
" and graſſes. All theſe have fibrous or ſtringy roots; that is, many ſmall ſtrings
" or wires, ſpringing altogether from the bottom of the plant, (by the bottom
" I mean the commiſſure of the ſuperficies, or part above ground and the root)
" and not one ſingle body of a root, divided afterwards into branches and fibres.
" In a barley-corn I have obſerved ſix of theſe fibres or ſtrings put forth before
" the blade began to ſtir.

" The pulp of theſe ſeeds ſerves for the nouriſhment of the young plant when
" tender, notwithſtanding it hath drawn root, as the yolk for the chicken's nou-
" riſhment for a while after it is excluded, notwithſtanding that it can feed itſelf
" by

" by the mouth. This may be evidently demonſtrated ſo to be in corn newly ſown: for if you pluck of it up at firſt ſpringing, you ſhall find the pulp in the grain almoſt entire; but afterwards plucking of it up from day to day, as it is older and older, you ſhall find ſtill leſs and leſs of the pulp remaining, till at laſt there be nothing left, but the empty huſk ſticking to the bottom of the plant. The pulp is, by the moiſture of the earth, ſtrained through the coats of the ſeed, diſſolved into a cremor like chyle or batter.

" In ſuch of theſe ſeeds, as are covered only with thinner teguments, as for example, wheat and rye, the leaf breaks the teguments, and comes forth at the ſame end with the roots: in others, that are covered with thick huſks, as barley and oats, the leaf creeps under the groſſer huſk to the oppoſite end, and there comes forth; notwithſtanding that the germen or young plant is made up alike and affixed to the ſame end of the grain; and the firſt ſhooting of both, leaf and root, be from the ſame point, as well in this kind as in the other.

" Of the ſecond ſort of ſeeds, in which the embryon-plant bears but a ſmall proportion to the pulp of the ſeed; viz. ſuch, in which it is incloſed in the middle of the pulp, as it were a pith, are 1. Pine-ſeeds, and I believe the ſeeds of all other coniferous and reſiniferous trees, in the kernels whereof you may find a young pine-tree, perfectly formed, ſtem and leaves, as it appears at firſt coming up out of the ground. 2. Aſh-ſeeds; in the middle of whoſe pulp you may find a little ſtem with two elegant leaves, not winged as the after-leaves are, but like two ſingle lobes of the after-leaves; ſo that this tree ſeems to belong to the genus of thoſe, whoſe ſeed is divided into two lobes, and comes up with two ſeed-leaves, whereas really it doth not. 3. Flower de luce ſeeds. 4. Aſparagus ſeeds: in both theſe laſt the pulp of the ſeed, all but the embryon-plant, is of a griſtly ſubſtance; which, whether it ſerves for nouriſhment or defence of the young plant, I know not. Theſe ſeeds of this kind I have obſerved, and queſtion not but there are many others of like nature.

" In theſe and the former ſort of ſeeds is true, what a great while ſince I publiſhed as a *general* obſervation; viz. that the ſeed at leaſt in moſt plants did contain, beſides the young plant, a convenient portion of nouriſhment for it while yet tender. But now I find in the moſt plants it holdeth not; for the far greateſt number of ſeeds contain nothing of nouriſhment for the young plant, more than the pulp of the lobes; which yet may, and moſt probably doth, ſupply nouriſhment to the radicle, while it is ſhot forth, and comes to draw from the ground for itſelf, and reciprocally for them too. For the lobes or ſeed-leaves in moſt ſeeds, while yet included, are thick, pulpy, and brittle; and conſequently have little of fibre, and much of fleſh.

" Of the ſecond ſort; viz. thoſe, in which the included plant makes up the whole pulp of the ſeed, are (I ſuppoſe) all bulbous plants: for, that theſe have no ſeed-leaves, but come up with leaves like the ſucceeding, is evident; and at firſt ſpringing up upon their leaf, the huſk of the ſeed empty, it is moſt probable, that there was nothing elſe in the ſeed but the young plant: for, had

" there

" there been any thing in the ſeed of nouriſhment for the young plant, moſt pro-
" bable it is, that the huſk being the veſſel containing ſuch nouriſhment, ſhould
" remain faſtened to the bottom of the plant, and not be brought up with the
" leaf. The next ſpring, I intend (God willing) by ocular inſpection to deter-
" mine this, and not to go upon probabilities.

" All ſeeds, when fallen from their plants on the earth, do at firſt draw their
" nouriſhment by the pores of their coats or teguments.

" There is great analogy between the nouriſhment and growth of the ſeeds of
" plants in the earth, and thoſe of viviparous animals in the womb. For, as
" the ſeed of a plant, when ripe, falls to the ground, and there lying looſe doth
" (as I ſaid) firſt receive its nouriſhment by the pores of its teguments, and after-
" wards ſtrikes root into the earth: ſo likewiſe the ſeed or egg of a viviparous
" animal, when ripened, as it were by the male, drops off one of the ovaria into
" the womb, where it lies for a while looſe and free, without any adheſion to, or
" connection with, the womb; drawing its nouriſhment through its involving
" membranes or ſecundines, and afterwards ſtriking, as it were, root into the womb,
" faſtens itſelf to it, and then probably draws at leaſt part of its nouriſhment
" that way: and in this reſpect, a man, as all other animals, may be ſaid to live
" firſt the life of a plant. By the ovaria, I mean the bodies uſually called teſtes
" fœminei, which whoſoever will but make uſe of his eyes, diligently to view in
" ſwine, and other multiparous and ſalacious animals, muſt needs acknowledge to
" be nothing elſe but maſſes or cluſters of eggs.

" Neither do the ſeeds, but I believe the roots of plants alſo, draw the greateſt
" part of their nouriſhment by the pores of their coats or barks, and but little
" by the extremities of their capillary fibres, which yet ſome have made to be
" ſo many oſcula or little mouths in plants, anſwering one great one in animals.
" That plants do draw by the pores of their barks, is evident from that manner
" of planting branches or ſlips of trees and ſhrubs mentioned by LAUREMBERGIUS.
" Firſt cut off the lower end of the ſlip to be planted, and having ſealed it cloſe
" up, put it into the ground bent, the middle of the bow being lowermoſt, and
" the lower or ſealed end inclining upwards, yet ſo as to remain ſtill covered with
" the earth, the upper end only appearing above ground. For in this caſe the
" nouriſhment can get in no way but by the pores of the bark, at leaſt if there
" be only one internodium covered.

" And now, that I have mentioned this way of planting by the ſlip, I ſhall add,
" that I cannot but think it would be worth the while to practiſe it in all ſorts
" of apple-trees, as well as in codlings and moyls; this being, of all others, if
" if it will ſucceed, the moſt eaſy and ſpeedy way of propagation. For, though
" a graft may bear fruit as ſoon as a ſlip, yet is the ſtock ſome years growing be-
" fore it be fit to graft on; and then, a ſlip growing much faſter will bear abun-
" dantly more fruit than a graft of its ſtanding. Now that it will ſucceed, I think
" moſt probable; there being no reaſon, why one tree of the ſame genus ſhould
" grow of the ſlip, and not another, though perchance with more difficulty. In
" this

" this opinion I was much confirmed by what I found in Mr. Josselyn's description of New England, viz. That the inhabitants there do practise, with good success, this manner of propagating all sorts of fruit-trees. If it be said, that trees thus planted will be shorter lived, and not last so long as those that are grafted; I answer: 1. I doubt much, whether this hath been sufficiently observed, and not rather presumed, and taken up on weak and insufficient grounds. For there seems to me to be the same reason, why a graft should be short-lived, as why a slip, which I conceive is, because both of them have already past their nonage, and are arrived at the age of fœcundity, being taken off branches already fruitful; and therefore all the time spent from the springing of the seed till its maturity is cut off from their lives, which is no disadvantage to the planter, the seed-plants remaining all that time unfruitful. 2. Suppose it were so as is said, the suddenness and copiousness of their bearing will abundantly compensate the shortness of their duration. For those, that last longer, are longer before they come to bear, and till that time they do unprofitably cumber the ground; whereas these are profitable soon after the time of their first setting; and when they come to be effete, they may then be cut down, and others planted in their room."

A discourse on the specific differences of plants.

" Having observed, that most herbarists mistaking many accidents for notes of specific distinction, which indeed are not, have unnecessarily multiplied beings, contrary to that well known philosophic precept; I think it may not be unuseful, in order to the determining of the number of species more certainly and agreeably to nature, to enumerate such accidents, and then give my reasons, why I judge them not sufficient to infer a specific difference.

" First then, such accidents are either of the whole plant or of the root, or of the stalk, or of the leaf, or of the flower, or of the fruit, or of the seed.

" 1. Of the whole plant, difference of magnitude from what is usual: so in Gerard's and Parkinson's herbals we find many plants put down for distinct species, which themselves confess to differ in no other point, than being in all parts less or greater than others of their kind before described. To which I might add difference of scent and taste, for which they make a sort of wormwood, different in kind from the common, calling it *absynthium insipidum & inodorum*.

" Accidents of the root mistaken for notes of specific difference are, first, diversity of colour; instances whereof we have in carrots, turneps, and radish; the root of the first, besides the usual colour, being found sometimes of a dark red or purple, sometimes white; that of the second sometimes yellow; that of the third, sometimes white, and sometimes black. Secondly, diversity of figure observed in turneps; which are sometimes long, though commonly round-root.

" 3. Differences of the ſtalk are its degenerating in many plants into a broad " and flat figure, or varying its number of angles, as in purple looſe-ſtriſe.

" 4. Accidents of the leaf are 1. Variegation, painting, ſtriping, or gilding. " Few plants there are but their leaves will now and then happen to be thus " painted: but thoſe, that are moſt prized, and charily nurſed up in gardens, are " painted holly, alaternus, box, roſemary, bitterſweet, ſage, hyſop, mint, mar- " joram, tanſy, melilot. 2. Curling of the edges of the leaves, obſerved in " lettice, endive, mint, parſley, tanſy, garden-creſſe, hart's-tongue. Though in " this accident, I confeſs myſelf not fully ſatisfied, that it is not a note of ſpeci- " fic diſtinction.

" 5. Accidents of the flower are, 1. Variety of colour, as white or carnation, in " ſuch as are naturally blue, red, or purple: ſcarce any plant of ſuch a coloured " flower but is ſometimes found with a white one. Here by the by we may take " notice, that plants of yellow flowers ſeldom change colour, growing wild, tho' " in gardens ſometimes they do, as I found in my own garden, in yellow-flowered " moth-mullein, the ſeed whereof ſowing itſelf, gave me ſome plants with a white " flower. I never yet obſerved any one of the numerous family of hawkweeds " to vary the colour of the flower. Beſides theſe diverſities of colour common to " many flowers, there are other almoſt infinite varieties in July-flowers, tulips, " anemonies, lark-ſpurs, columbines, bears-ears, poppies, ſtock gilliflowers and " others.

" 2. Multiplicity of leaves, or doubleneſs of the flower; of which inſtances are " infinite. Yet ſome whole tribes of plants were never, that I know of, obſerved " to produce double flowers; as for example, the umbelliferous, verticillati and " papilionaceous kinds.

" 3. Gemination of the flower, in ſuch as we call hoſe in hoſe, which is a varie- " ty, for ought I know, peculiar to primroſes, cowſlips, and paigles.

" 4. Nakedneſs of the flower in ſuch as have it uſually radiate, as is ob- " ſerved in camomile, mayweed, feverfew, and the like.

" 5. Fiſtulouſneſs or hollowneſs of the flower-leaves in ſuch as have them " uſually flat, as is ſeen in the double-daiſy and African marygold.

" 6. Proliferouſneſs of the flower in childing daiſy, ſcabious and other plants " with a compound flower.

" 6. Accidents of the fruit are differences of magnitude, taſte, figure, colour, " which are in apples, pears, and plums, almoſt infinite.

" Laſtly, accidents of the ſeed are variety of colour obſervable in the ſeed of " millet, which is found of a yellow and golden colour; of maiz or Indian

" wheat,

" wheat, which is sometimes spadiceous; of common beans, which are some-
" times red; and of kidney-beans, which are of many differing colours.

" Having now enumerated the accidents, it remains that I give my reasons, why
" I judge them not sufficient notes of specific distinction.

" First, as to the difference of magnitude; though I grant there are certain
" measures or bounds of littleness and greatness, which neither plants nor ani-
" mals of the same species can exceed or fall short of; as, for example, a sheep
" can never come to be so big as an elephant, or so little as a mouse; nor a goose-
" berry bush so tall as an oak, or so low as millegrana: yet is there a very great
" latitude in point of magnitude between plants of the same species, of ten sometimes
" to one, which yet is wholly to be imputed either to the richness or poverty of
" the soil, the moistness or drought of the season, the coldness or heat of the cli-
" mate, or some other such like external circumstances, and not to the specific
" nature of the plant: which is evident in that, if you take the seed of the smallest
" and poorest plant in its kind, provided it will admit culture, and sow it in a
" rich soil, you shall soon get an offspring ten times as great as the mother-plant.
" Nay, take the root of a perennial and removeable plant from off a cold barren
" mountain, and set it in a fat warm garden, it shall attain twice the stature and
" dimensions, which it would have been confined to, had it remained in its na-
" tural place. No less difference is there, in this respect, between animals of the
" same species; we having in England of sheep from five to fifty pounds a score;
" and of beeves from three to twenty pounds a-head. And for horses, I have
" seen many in New Wales, that for bigness did not exceed some dogs; and
" for price were rated at no more than half a crown or ten groats a-piece.

" 2dly, Variegation of leaves in gilded box, rosemary, and the like, is so far
" from being a mark of specific difference, that it is only a symptom of a mor-
" bid constitution of such plant, induced by the application of lime, rubbish, or
" other mixture to the root of it.

" 3dly, Diversity of colour in the flower, or taste in the fruit, is no better note
" of specific difference in plants, than the like varieties of hair or skin, or taste
" of flesh in animals; so that one may, with as good reason, admit a blackmore
" and European to be two species of men, or a black cow and a white to be two
" sorts of kine, as two plants, differing only in colour of flower, to be specifi-
" cally distinct; such varieties, both in animals and plants, being occasioned either
" by diversity of climate, and temperature of the air, or of nourishment and man-
" ner of living.

" 1. What influence diversity of climate, place, or temperature of the air may
" have as to the alteration of these qualities, appears in many animals, which on
" the Alps and other high mountains, as also in those cold and northern coun-
" tries, where the earth for more than half the year is continually covered with
" snow, are not rarely found white, though naturally of different colours: as for
" example, bears, foxes, hares, ravens, blackbirds. I know not, whether I ought

"to refer to this head, or that of the diverſity of nouriſhment, the difference "between Engliſh and Flemiſh horſes; and between our Engliſh Lancaſhire and "Suſſex beaſts, of which the former have fair and well ſpread horns, the latter "ſmall and crumpled; and, if out of Lancaſhire you tranſlate theſe cattle into "Suſſex, their race by degrees will degenerate, and come to be of the ſhape of "the natives.

"2. The like, and greater, influence hath the diverſity and plenty of food, "and different manner of living, as is manifeſt in domeſtic animals; for example, "ſwine, ducks, and geeſe, which do frequently and almoſt infinitely vary their "colours; whereas the wild, of thoſe kinds, retain conſtantly the ſame, and not "their colours only, but alſo the taſtes of their fleſh; it requiring no very critical "pallate to diſtinguiſh by the taſte, of fleſh of tame and wild fowl: nay, it hath "been told me for a truth by perſons of good credit, that there is a paſture on "a hill called Haſelbedge, near Little Hucklow in the Peak of Derbyſhire, which "will turn the hair of all kine, that feed upon it, in three years time to a grey "colour. Of all other animals, dogs are by theſe circumſtances moſt diverſi-"fied, inſomuch, that many animals of different ſpecies differ not more in ſhape, "magnitude, colour, and ſeveral other accidents, than they do. Now, if diver-"ſity of food, climate, and ſuch like accidents, may effect ſuch differences "among animals of the ſame ſpecies, much more may they among plants, "which are leſs free in the choice of their nouriſhment, and conſtantly affixed "to the place where they chance to ſpring up.

"4. I prove in general, that none of the forementioned varieties are diſtinct "ſpecies, becauſe they will ſpring frequently from the ſeed of the ſame indi-"vidual plant.

"5. Becauſe by ſeed they will not propagate their kind, but give you plants "of the uſual figure and colour; the only ſure way to propagate ſuch plants "being by off-ſetts from the root, if they be bulbous, or by ſlips and branches, "if others.

"6. Many of theſe varieties, if they ſtand long in one place without culture, "will by degrees degenerate, becoming of double, ſingle-flowered, and changing "from rare to common colours. I might add, as a further argument, that I "have obſerved on the ſame root, for example, of a ſtock gillyflower ſome "flowers ſingle and ſome double.

"But, becauſe theſe varieties of flowers, for their beauty and rarity, are highly "prized and deſired by the curious; and thoſe of fruits do no leſs gratify the "pallate than theſe the eye, it were deſirable to know certainly, how ſuch va-"rieties might be produced. Firſt, one means to advance plants from ſingle "to double flowered is by frequent removals. LAUREMBERGIUS ſaith [k], that "he hath often tried in julyflowers, and found, that ſingle ones, by being re-

[k] Horticul. lib. 1. cap. 28. § 3.

"moved

" moved first in the spring, then in the autumn, and afterwards again the spring
" following, and not permitted to flower in the mean time, have all come to bear
" double flowers. 2. One means to diversify the colour of the flower is, by wa-
" tering them only with water deeply tinged with the colour you would have
" the flower to be of. LAUREMBERGIUS, in several places of his book de Hor-
" ticultura, inculcates this experiment, lib. 1. cap. 31. § 5. Item, cap. 19.
" § 10. and cap. 13. § 6. he thus prescribes the manner of making it: Fill
" a vessel of what size or fashion you please with very fat earth, dried in the
" sun or sifted, and therein plant a slip or branch of a plant bearing a white
" flower (for such only can be tinged;) use no other water to water it with, but
" such as is tinctured with red, if you desire red flowers, with green, if green,
" &c. With such coloured water water it twice a day, morning and even-
" ing, removing it into a house by night, so that it drink not of the morning
" or evening dew for three weeks space. You shall (saith he) experience, that it
" will produce flowers tinctured, not altogether with that colour, wherewith you
" watered it, but partly with that, partly with the natural.

" 3. The most sure and facil way to get plants different, either in colour or
" multiplicity of flower, is to sow the seeds of those plants, of which you desire
" such varieties, in a rich soil, or one different from what is natural to such
" plants when wild. For, if you sow the seed, for example, of a single july-
" flower in good ground, among many that bear single flowers, it shall give you
" some roots, that yield double, and some of different colours, from the mother-
" plant, which you may afterward propagate by the slip. The plants, that are
" most apt to be thus diversified by sowing, are julyflowers, anemonies, lark-
" spurs, columbines, bears ears, stocks, and wall-flowers, primroses and cow-
" slips, tulips, crocuses, blue-bottles, daisies, hepaticas, and violets.

" As for fruits, the ready, and, I believe, only way to get new kinds is by
" sowing their seeds, stones, or kernels, in rich ground, or, perchance, any
" common ground, which will give you wildings, bearing fruit of a different
" figure, colour, magnitude, or taste, from the tree of which they came, whose
" tastes may be mended and improved by culture and insition. But that by in-
" sitions only new species of fruits may be produced, is to me incredible, I
" having hitherto embraced, as an undoubted maxim in planting, that the fruit
" always follows the cyon.

" By this way of sowing may new varieties of flowers and fruits be still pro-
" duced in infinitum, which affords me another argument to prove them not
" specifically distinct; the number of species being in nature certain and deter-
" minate, as is generally acknowledged by philosophers, and might be proved
" also by divine authority, God having finished his works of creation, that is,
" consummated the number of species, in six days."

Mr. HOOKE produced and explained his model for horizontal sails, being per-
suaded, that he had improved that position of sails to the greatest perfection; of
which

which it was capable; since those sails could not, in his opinion, be put in any posture more advantageous than that, which he exhibited.

It being mentioned, that there would be a total eclipse of the moon on the 1st of January next; and intimated withal, that Sir WILLIAM PETTY had erected a very convenient observatory at his own house; Mr. HOOKE was desired to assist there in making observation of the said eclipse, and to provide instruments necessary for it.

167 4/5. *January* 7. A letter from Dr. LISTER to Mr. OLDENBURG, dated at York, November 24, 1674, was read, concerning some observations and experiments, viz:

1. Of the efflorescence of certain mineral globes. 2. An odd figured iris. 3. Of a *glossopetra tricuspis non serrata*. 4. Of certain *lapides Judaici*, for kind found in England. 5. Of the electrical power of stones in relation to a vegetable rosin. 6. Of the flower and seeds of mushrooms. 7. Of the speedy vitrifying of the whole body of antimony by cawk. This letter was ordered to be entered[g], and the author desired to perfect and publish it. The several substances accompanying it were delivered to Mr. HOOKE for the repository. And it being thought, that the vitrified antimony might serve for perspectives, Mr. OLDENBURG was desired to write to Mr. LISTER for some quantity of that cawk, employed in the vitrification.

Mr. OLDENBURG presented from Mr. BOYLE his newly printed book, intitled *Tracts, containing*, 1. *Suspicions about some hidden qualities of the air*; *with an appendix touching celestial magnets, and some other particulars.* 2. *Animadversions upon Mr. Hobbes's* Problemata de Vacuo. 3. *A discourse of the cause of attraction by suction:* printed at London, 1674, in 8vo.

Mr. OLDENBURG delivered to Mr. HOOKE three papers concerning Mr. HENSHAW's presents lately made to the Society.

Dr. DANIEL COXE presented the Society with a bottle full of the volatile spirit and salt of wormwood, extracted in the manner published by him; which liquor was as pungent as any volatile salt of hartshorn or soot, &c. can be.

January 14. At a meeting of the COUNCIL were present

Sir WILLIAM PETTY, vice-president, in the chair,

The earl of Aylesbury,	Dr. WHISTLER,
Sir JAMES SHAEN,	Mr. COLWALL,
Mr. HENSHAW,	Mr. HILL,
Mr. PEPYS,	Mr. OLDENBURG.
Dr. GODDARD,	

[g] Letter-book, vol. vii. p. 112. It is printed in the Philos. Transact. vol. ix. n° 110. p. 221. for January, 167 4/5.

The

The committee for disposing of the four hundred pounds legacy upon fee-farm rents being called upon for a report, Mr. HILL reported from Sir JOHN LOWTHER and Sir JOHN BANKES, that they had found upon the books three fee-farm rents payable from Lewes in Sussex (whereof one from the estate of the earl marshal) amounting in all to twenty-four pounds *per ann.*

The consideration of this was referred to the next meeting of the council.

No report was ready from the committee for considering of the disposing of Chelsea-College.

Several members of the council named the respective days, when they would provide each a discourse for the Society, viz.

The earl of Aylesbury - - - - - - February 11, 167$\frac{4}{5}$.

Mr. HENSHAW - - - - - - - - - 18.

Sir JAMES SHAEN the first meeting after Easter.

Mr. PEPYS the second meeting after the next recess, the president being said by him to have named for himself the first meeting-day after the second recess.

Mr. EVELYN of the Society took the 1st of April, 1675.

Sir WILLIAM PETTY having proposed Mr. BARLOW as a person fit to collect the arrears due to the Society, it was ordered, that the said Mr. BARLOW be employed for that purpose, he giving his bond of one hundred pounds for his fidelity in delivering the monies by him collected to Mr. DANIEL COLWALL, as treasurer to the Royal Society: and that he, the said collector, do from time to time receive orders from Mr. COLWALL as to the persons being in arrears, and the respective sums due from them; and that he be allowed twelve pence per pound for all such sums, as shall have been collected and brought in by him.

At a meeting of the SOCIETY on the same day,

Sir PAUL WHICHCOTE, Bart. and Mr. MILLES were elected.

Mr. HOOKE read his observations of the late lunar eclipse of January 1st, at which were present the president, Sir JONAS MOORE, and Mr. COLLINS. He was desired to perfect this discourse, and to publish it [h].

There was read out of the Register Mr. BOYLE's discourse of freezing, formerly given in by him [i].

[h] See Philosoph. Transact. vol. ix. n° 111. p. 237.

[i] Probably that read before the Society, 23d November, 1671. See above, vol. ii. p. 492.

This gave occaſion to ſuggeſt ſeveral experiments to be made, as, 1. To exhauſt water, both boiled and raw, of air, in order to ſee, whether it would ſwell as much, as if not exhauſted. 2. To tinge ſeveral liquors both with vegetable tinctures and mineral ones, as with Roman vitrol, verdigreeſe, &c. 3. To mix burnt alabaſter and water together, to ſee the force of the extenſion of that mixture.

January 21. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

Sir JOHN BANKES,	Dr. GODDARD,
Mr. HENSHAW,	Mr. COLWALL,
Mr. PEPYS,	Mr. HILL,
Mr. HOSKYNS,	Mr. OLDENBURG.

Sir JOHN BANKES made a full report concerning the three fee-farm rents payable from Lewes in Suſſex; concerning which the council accepted of the propoſal, and reſolved to diſpoſe of the four hundred pounds legacy of the late Dr. WILKINS, biſhop of Cheſter, for purchaſing of them; and accordingly deſired Mr. HOSKYNS to take care of a legal conveyance of the ſame to the Royal Society and their ſucceſſors.

A report being made, that about ſixty fellows of the Society had ſigned and ſealed the new obligation, which was the number, that was thought fit to be aſſured of before the ſending about the printed declararions, it was reſolved upon, that a letter ſhould be drawn up by the ſecretary againſt the next meeting of the council, to accompany the ſeveral copies of the declaration, to be ſent to all ſuch, as were not excepted by the ſame: and that the ſubſtance of that letter be to deſire the reſpective members to conſider the contents of that declaration, and to return an anſwer thereunto within ſuch a time, as ſhould be limited by the preſident, who was to ſign both the letter and the declaration.

It being conſidered, that the forty ſhillings to be paid by thoſe members of the council, who ſhould fail of giving a lecture, would not be eſteemed a ſufficient recompenſe to him, who ſhould ſupply their place, it was agreed, that forty ſhillings ſhould be added thereto out of the ſtock of the Society.

Mr. OLDENBURG mentioned, that the earl of Ayleſbury being obliged to go out of town, could not take care of providing a lecture, as he thought to have done for the 11th of February, and had therefore ſent to him his forty ſhillings: which money was delivered to the treaſurer.

It was ordered, that a diſcourſe made before the Society, 10th December, 1674, by Dr. NEHEMIAH GREW concerning the nature, cauſes, and power of mixture, be printed by the printer of the Society.

At a meeting of the SOCIETY on the ſame day,

Sir

Sir Robert Southwell presented to the Society for the repository a very curious hammock made of the bark of a tree.

Dr. Daniel Coxe entertained the Society with a lecture concerning the analysis of vegetables, dividing his subject into several heads, which, he said, had furnished him with matter sufficient for several lectures.

This lecture treated chiefly of the several methods of analysing plants.

It gave occasion of debating the question, whether there were no alcalisate salt but by burning? And, whether some particles of the air did not unite with some parts of the vegetables burned, precipitating themselves with them, and so forming an alkali?

It gave likewise occasion to debate Mr. Hooke's notion of the nature of trees, viz. that it consists in the dissolution of bodies by air.

Mr. Hooke intimated also upon occasion, that he hoped he should be able to make it out, that a body may be made springy out of particles, that have no spring.

He was desired to endeavour to prove this by experiment as soon as he could.

January 28. At a meeting of the Council were present

The lord viscount Brouncker, president,

Sir John Lowther,	Mr. Henshaw,
Sir James Shaen,	Dr. Goddard,
Sir William Petty,	Mr. Colwall,
Sir William Southwell,	Mr. Hill,
Sir John Bankes,	Mr. Oldenburg.

Sir John Bankes produced the conveyance of the twenty-four pounds fee-farm rents yearly, payable from Lewes in Sussex.

It was ordered, that the 400 pounds, being the legacy of the late Dr. Wilkins to the Society, should be paid out to Sir John Bankes for the said conveyance: and that the president, treasurer, and secretary be desired to bring with them on the Thursday following the three keys of the iron chest, which contains the money.

There was read a draught of a letter to be sent to those, who had not signed the new bond, whether in London, or absent from it; together with a copy of the printed declaration. The time for an answer limited to those, who were in London, was the 11th of February following; the time for the absent was a month from the date of the respective letters to them.

It was ordered, that the amanuensis make fair copies of this letter, first of all to the following persons:

The lord Annesley,
Sir Robert Atkyns,
Sir Charles Berkley,
Sir John Birkenhead,
The lord Brereton,
Mr. Gilbert Burnet,
Sir Edward Bysshe,
Mr. Carkesse,
The earl of Carlisle,
The lord Cavendish,
The lord bishop of Chester,
Sir Winstone Churchill,
The lord Clifford,
Capt. Cocke,
Col. Colepepper,
Dr. Thomas Cox,
The marquis of Dorchester,
The earl of Dorset,
Dr. Downs,
Sir George Ent,
The lord viscount Fitzharding,
Mr. Hoare,
Dr. Holder,
Mr. Locke,
Sir James Long,
Dr. Merret,
Mr. Nolthrope,
Sir Thomas Notte,
The earl of Northampton,
Mr. Oudart,
Dr. Samuel Parker,
Sir Peter Pett,
The earl of Peterborough,
Mr. Povey,
Lord viscount Ranalagh,
Mr. Slingesby,
Mr. Soame,
Sir John Talbot,
Mr. Waller,
Dr. Willis,
Dr. Woodford,
Dr. Woodroffe,
Dr. Thomas Wren,
Mr. Wynde,
Lord viscount Yarmouth.

The president signified, that he would make his discourse at the first meeting of the Society after the next recess.

Mr. Pepys offered to make his the next week after the president.

Sir William Petty the next after Mr. Pepys.

Sir Robert Southwell took for his discourse the 2d week in April, as Mr. Evelyn had done the first week in that month.

Mr. Oldenburg having desired the council's license for the printing Dr. Wallis's discourse on gravity and gravitation, made before the Society the 12th November, 1674, it was

Ordered, that the said discourse be printed by the printer of the Society.

Mr. Oldenburg having mentioned, that Mr. Newton had intimated his being now in such circumstances, that he desired to be excused from the weekly payments, it was agreed to by the council, that he should be dispensed with, as several others were.

At

At a meeting of the Society on the same day,

Dr. Edmund Castell was admitted.

Mr. Hooke read his discourse concerning his new contrivance of a Helioscope and divers other useful instruments [l]. The helioscope was for observing the sun without offending the tenderest eye by the help of several reflecting-glasses weakening the strokes of the sun-beams.

It was ordered, that the helioscope should be fixed and tried on the first sun-shiny-day.

It was intimated, that a good composition of metal for reflecting was very desirable.

Mr. Oldenburg produced Signor Malpighi's philosophical present concerning the anatomy of plants both in a manuscript discourse and very elegant figures sent to him from Venice by sea.

Signor Malpighi's letter to Mr. Oldenburg, dated at Bologna, 20th August, 1674 [m], accompanying this present, was read.

It was ordered, that a letter of solemn thanks to the author should be drawn up [n]; and the council be desired to consider of a way of having it well printed.

A letter of Monf. Huygens to Mr. Oldenburg, dated at Paris, 30th January, 167$\frac{4}{5}$ [o], was read, giving notice of a new invention of watches by himself, the secret of which he conceals in an anagram,

	4	1	3	5	3	7	3	1	2	3	4	3	2	4	2
viz.	a.	b.	c.	e.	f.	i.	l.	m.	n.	o.	r.	s.	t.	u.	x.

February 4. Sir Philip Percival, Bart. was proposed candidate by Sir Robert Southwell.

Dr. King presented to the Society his discourse, consisting of the following particulars:

1. That most, if not all, the parts of an animal body do consist of tubes and liquors.

2. That all the vessels of the body are chiefly made up of other vessels.

[l] Mr. Hooke's *Description of helioscopes and some other instruments made by him*, was printed at London, 1675, in 4to.

[m] Letter-book, vol. vii. p. 100.

[n] Mr. Oldenburg's letter to Signor Malpighi was dated 26th February, 167$\frac{4}{5}$, and entered in the Letter book, vol. vii. p. 200.

[o] Ibid. p. 125.

 3. The

3. That all veſſels and other tubular parts have their ſhare of carneous or other moving fibres, and act in their ſeveral ſpheres as the muſcles.

4. That all the contents of all tubular parts are carried about into all parts of the body, or out of it, according as they are ſeverally deſigned, by muſcular motion voluntary or involuntary.

5. That moſt diſeaſes, which our bodies are afflicted with, take their principal riſe from the impeded or irregular motion of the liquors and ſpirits, or their recrements left in the tubes or cavities.

6. Some obſervations upon the compoſition and motion of membranes.

7. The manner of the circulation of the blood, grounded upon the fabric of the heart and arteries.

He was deſired to leave his diſcourſe to be regiſtered with the reſt, which he promiſed to do, as ſoon as he had reviſed it [p].

Upon the occaſion given by this diſcourſe concerning muſcular motion Mr. Hooke declared, that he had made ſome diſcovery of the ſtructure of a muſcle by inſpection with a microſcope.

Dr. Grew ſuppoſing, that that diſcovery might have been the ſame with what he had ſome time ſince diſcovered, acquainted the Society, that he had ſome time ſince diſcovered, that the fleſhy part of a muſcle was divided into a ſort of long parallelopipeds by the croſs interweaving of ſmall membranes and veſſels croſſing the ſaid fleſhy part.

Dr. Croune ſuppoſed theſe fleſhy parallelopipeds to conſiſt of a chain of bladders, which being blown up by certain liquors ſhorten the ſaid ſprings, and ſo contract the muſcle.

But Mr. Hooke affirmed, that he could not diſcover any ſuch texture in the ſaid fleſhy part, but that his obſervation was, that the fleſhy part of a muſcle conſiſts of an infinite number of exceedingly ſmall round pipes, extended between the two tendons of the muſcle, and ſeem to end in theſe: which tendons in the muſcles of beef boiled would be eaſily ſtripped off from the ends of thoſe pipes, and ſo leave the ends of the round pipes very diſtinct. He ſaid, that the reaſon of the moving of a muſcle might be from the filling or emptying of thoſe pipes, whoſe ſides ſeem to be flexible like thoſe of a gut.

They were all deſired to make out their reſpective notions about the fabric of muſcles by occular demonſtration.

[p] It does not appear in the Regiſter.

February

February 11. Sir Paul Whichcote and Mr. Daniel Milles were elected.

Dr. Croune read his discourse concerning the manner, how flying is performed by birds; shewing, in order thereunto, the structure of a duck's wing and body, especially of the muscles and their insertions into the humerus.

This discourse was ordered to be registered [q], though the doctor did not then leave it with the Society.

He having intimated a quite different structure of the body of man from that of birds, and thence concluded his utter unfitness for flying, gave occasion to some of the members to remark, that what nature had denied to the body of man, might be supplied by his reason and by art.

Mr. Hooke intimated, that there was a way, which he knew, to produce strength, so as to give to one man the strength of ten or twenty men or more, and to contrive muscles for him of an equivalent strength to those in birds. He hinted likewise, that a contrivance might be made of something more proper for the feet of man to tread the air, than for his arms to beat the air.

Sir William Petty mentioned, that perhaps it might prove of use to consider, whether gun-powder, being of so great and quick a force, might not be slackened to give a slower motion, as in the mortar-piece the shell is much more slowly carried through the air than a bullet out of a musket.

Some said, that it would be of real use to contrive something for flying, if it were but to raise a man so high, as to fly over a wall, and the besiegers of a town to carry and bring back intelligence.

Mr. Oldenburg read a letter to him from Monf. Bullialdus, dated at Paris, 6th February 167 4/5 [r], concerning the observations of the royal academy of sciences and his own of the lunar eclipse of $\frac{1}{11}$ January preceding [s]; as also his opinion about telescopical sights, declaring himself of that of Mr. Hevelius.

It was ordered, that the observations that eclipse made in England should be sent to Monf. Bullialdus, according to his desire.

February 18. Mr. Isaac Newton, James Hoare, *junior*, Esq; were admitted.

Sir Philip Percival was elected.

Mr. Henshaw read his discourse, giving an account of his observations made

[q] It does not appear in the Register.
[r] Letter-book, vol. vii. p. 227.
[s] They are printed in the Philosoph. Transact. vol. ix. nº 111. p. 238. for February, 167 4/5.

in

in Denmark and in his voyage thither; which was ordered to be registered[t], and is as follows;

My Lord,

" It being appointed me, this day, to entertain this learned meeting, with a " discourse of some matters relating to experimental philosophy, made me con- " sider, that though from my childhood I have ever had a great affection and " inclination to the speculations of Natural Philosophy; yet the great troubles I " have had for many years, concerning my own private estate, have in a man- " ner wholly diverted me from making any considerable progress in that science; " and since that my time hath been almost wholly taken up for near three years, " last past, by the duties of an employment in Denmark his majesty was pleased " to honour me with: so that, instead of better digested notions my study might " have furnished me with had I had leisure, I here adventure to offer you some " occasional observations about natural things, I made in my voyage to Den- " mark, and during my abode in that country, which, I hope, will not be " thought to deviate much from the design of these weekly exercises; since in- " quiries into the histories of all countries are part of your method for the ad- " vancement of science; and, though I am sure the observations I here present " you will be very crude, for the want I had of skill and leisure better to concoct " them, yet they may serve for incitements to those of greater ability and cu- " riosity to perfect them.

" The first thing then, that I considered more heedfully than I had done in " any former voyage I had made, was, that when a ship of a considerable burthen " had sailed from us little more than a league or three miles (as the seamen judged) " we lost the sight of almost all her hull or body, and in a short time after could " see nothing but her masts and sails. I was standing then on the quarter-deck " of a frigat of the king's, of fifty guns, called the Portland, where, as I guess, " my feet were about eighteen foot from the water, consequently my eye five foot " higher, and the highest part of the body of the other ship was, as I judged, " about fifteen foot above the water. I had formerly, on the like occasions, sa- " tisfied myself, that it was the convexity only of the water, that thus took " away the sight of a ship from us at so small a distance; but at that time, consi- " dering with myself, that if the circumference of this globe of earth and water " we inhabit, were but, as it is vulgarly reputed, twenty-one thousand and six " hundred miles (though I did not give myself the trouble to try, whether I was " able to calculate what the sinus versus of an arch of three miles of that circum- " ference might come to) it was highly improbable, that the convexity of so " small an arch could be so great, as wholly to intercept the body of a ship fifteen " foot high from an eye raised twenty-three foot above the water. Therefore hav- " ing in my cabin three perspectives of Mr. Cock's making, fitted with day-glasses, " the one of two foot, the other of four, the third of six foot length; I was re- " solved to try what they could discover to me; and accordingly, getting them " in a readiness, when the next ship sailed by, just as, to my eyes, we lost the " sight of her hull, I applied the two foot tube, and found I did recover sight of

[t] Register, vol. v. p. 53.

" some

“ some part of her hull, with the four foot tube more visibly, and with the six
“ foot tube about half her hull, as near as I could guess. I made the trial two
“ or three times more, with much-what the same success, to my apprehension;
“ which made me think, that if I had had a longer tube, I might yet have dis-
“ covered some more of the hull, that before had disappeared; but I could not re-
“ peat this experiment so oft as I desired for my fuller satisfaction; for, what op-
“ portunity I had, was while we rid at an anchor wind-bound at the buoy in the
“ gunfleet; and after that, by reason the war was already begun between Eng-
“ land and Holland we scarce saw a ship but what sailed in our company, till
“ we came to Denmark; so that, upon these small trials I made, it seems to me
“ very probable, that the vaporous and thick air, that floats always above the sur-
“ face of the sea, intercepts the sight of a ship at so small a distance as a league,
“ much more than the convexity of the water. That, which persuades me, there
“ are continually such vapours hovering near the superficies of the sea, though
“ the air appears never so clear above, and they themselves not perceptible to
“ us, unless we look through them on some object at a known distance, is, *first*,
“ those trembling steams we see every where arise plentifully out of the earth,
“ in a bright day in summer, if we bring our eye near the earth, which we
“ do not at all discover, if we stand upright; whereas the sea must needs ex-
“ hale them in greater abundance when warmed by the heat of the sun, being
“ a body so easily dissipable, that the very motion of the sea is sufficient to crowd
“ out continually some smaller particles of it; besides what the winds constantly
“ shave off, when they move horizontally on the surface of it, as we may justly
“ conjecture by what they do on ways and wet linen, which dry suddenly in windy
“ weather. And that it is in the nature of vapours to slide, and play, and
“ hold longer together on a moist and smooth superficies, but dissipate and ra-
“ rify when they get higher up into the air, may be evidenced by blowing tobac-
“ co on any liquor spilt on a table, especially if the liquor stagnate with a con-
“ vexity.

“ The next remarkable thing in our voyage was, that being driven by a south-
“ west wind to near sixty degrees of northern latitude, and coming to an anchor
“ on the of May, 1672, close under the coast of Norway, though the
“ weather was very clear and calm, but cold, we saw the sun three evenings to-
“ gether, near his setting, of a perfect elliptical or oval figure; which sight, I con-
“ fess, I was the more gratified with, because I have very many times in Eng-
“ land attended on his setting at several seasons of the year, to that purpose,
“ though I could never confidently say, I saw it of that figure till this time. The
“ first, that ever we read of, that took notice of this admirable phænomenon was
“ Christopher Scheiner, the jesuit; who also first discovered the spots in the
“ sun, who by chance found out this appearance at Ingolstadt in Bavaria, in the la-
“ titude of forty-eight degrees and forty minutes, in the month of September, 1612,
“ as he was one evening at sun-set endeavouring to discover spots in the sun with
“ his bare eyes. He was so surprised with so strange an appearance, that he could
“ hardly believe his own sight, till he had verified it by many trials the winter
“ following, especially by transmitting the appearance of the sun through an op-
“ tic tube on a white paper in a dark room, the way he used to observe the spots

“ in

" in the sun by; but the greatest difference he could discover, at any time between " the diameter of the sun's longitude and that of his altitude, as he calls them " (though I think the perpendicular and horizontal diameters be more intelligible) " was seven minutes and forty-three seconds, reckoning the sun's visual diame- " ter at thirty-four seconds; whereas in this elliptical appearance of the sun to us " in Norway, the perpendicular diameter seemed shorter to us than the horizon- " tal by at least a fourth part, as was judged, not only by myself, but also by " several able seamen and others that observed it with me; that is, as far as we " could estimate it by our bare eyes; for we had no conveniency to try it SCHEI- " NER's way. At the beginning of March following, I observed the like ellipti- " cal appearance of the sun for two evenings together, as I went to take the air " in my coach without the north port of Copenhagen, saving that then the per- " pendicular diameter seemed to me, and to two learned men that were in the " coach with me, to be but one fifth part shorter than the horizontal diameter, " and we were both times between the town and the sun when it appeared; so that " nothing of the smoke of the city was concerned in it. SCHEINER was so taken " with this phænomenon, that he hath written a pretty large treatise in 4to con- " cerning it; wherein he endeavours to shew the reason of this appearance by an " oblique refraction of the light of a candle, through a glass, that has one super- " ficies convex, the other concave, both ground on segments of the same sphere: " but because every man, that desires that satisfaction, may find it in his book, I " shall forbear to give the particulars of his demonstration; but if any one, here " present, desires to save himself the trouble, I can tolerably make it out with a " glass in my pocket.

" After a tedious passage of six weeks at sea by reason of calms, and contrary " winds, that is easterly winds, which commonly in this part of the world are " predominant for three months of the year, that is February, March, and April, " we arrived the 15th of May, 1672, at the town of Elsineur in Zealand, most " pleasantly seated on that side, which has the greatest command of the Sound; " for though the entrance is four English miles broad, yet the deepest and most " navigable part of it lies close under the walls of the strong castle of Croneng- " burg, situate at the upper end of the town. The weather was pretty warm " there, which made the channels of that town, which are not well contrived to " carry off their sullage, stink so insufferably, that our heads and stomachs were " much disordered by the smell. To refresh myself, as I hoped, I got some " company to walk with me toward the sea shore, but there we were entertained " with a higher degree of the same stink, which came off the shore, and so we " found it almost all the way in our journey to Copenhagen, the high-way lying " almost all the way very near the sea; it being otherwise the pleasantest pas- " sage of tweny-five miles that ever I rode any where: and this smell is thus " troublesome all the summer long, whenever the wind has sat for three or four " days from the shore on the other side. I enquired of several, though I confess " no great philosophers, what was the reason of that stink: they could only tell " me, that it was the nature of that sea to smell so in the summer, but that I " quickly found was not so; for when the wind sat north, south, or west, there " was no ill smell at all; having, during the time of my abode there, very of-

" ten occaſion to paſs by that ſhore, I took notice, that almoſt all along great heaps " of ſea wrack, or a ſea-weed, called in England kelp, ſuch as they lay on the " top of barrels of oiſters, had been thrown up by the ſea in ſtormy weather. " This kelp, when there came no ſtink from the ſhore, I found was dry, and be- " ing taken up in my hand had ſcarce any ſmell at all, but when it ſtunk it was " always wet, the wind from the oppoſite ſhore having daſhed a great deal of ſea- " water into it, which in the ſummer did quickly putrify and ſtink. It may ſeem " ſtrange to thoſe, who have not been acquainted with the abominable ſmell of " ſea-water pumped out of a tight ſhip (which the ſcent of this ſhore did re- " ſemble) that ſalt-water ſhould be apt to ſtink; and it would have done ſo to " me too, had I not ſeen the experience of it here in England, that ſea-water " kept a while in a tub will ſtink ſooner and worſe than rain-water: for though " we find, that ſalt preſerves fleſh and fiſh, and ſuch like things from putrefaction, " becauſe it not only dries up their ſuperfluous moiſture, which would quickly " colliquate their parts, and lead them to putrefaction, but by entering into all " their pores it conſtipates and conſolidates their parts; yet ſalt in water be- " ing to perform neither of theſe offices, the heat, that is in ſalt, doth there co- " operate with the warmth of the ambient air to promote putrefaction.

" Denmark doth ſpontaneouſly produce beech-trees in as great plenty as Sweden " doth fir and birch-trees. In all the provinces of Denmark, where I have been, " I have obſerved not only fine groves, but goodly foreſts, conſiſting for the moſt " part of beech, and fairer trees of that kind than I have ſeen any where, which " is a kind providence, for ſo cold a country to be furniſhed with ſuch ſtore of " excellent fuel. The oaks in Zealand are but few, and for the moſt part crooked, " ſmall, and not fit for timber; though in Jutland there is pretty ſtore of them, " and many of them of ſtately growth. There hath formerly, it ſeems, been " greater plenty; for now oak-timber is a commodity prohibited under ſevere " penalties to be carried out of that king's dominions. Neither elms nor fir-trees " grow ſpontaneouſly in that kingdom, and very few aſhes; alders grow in moiſt " places there, but only to ſhrubs; nor have I ſeen an alder there big enough to " make a hop-pole. Some few maples there are, and thoſe but ſhrubs. There is " great plenty of hazel every where in that country, but eſpecially in the iſland " of Ween, or, as the Engliſh call it, the Scarlet Iſland; ſo that they lade ſeveral " barks in that country, at the time of the year, with nuts for Holland. I have " been three times in that iſland; the firſt time I went on purpoſe to ſee what " ruins were left of Urani-Burgum, or Tycho Brahé's aſtronomical palace, but " it is now razed to the ground, and only ſome rubbiſh of the foundation left. " The oaks there are ſtrangely ſubject to be ſpoiled by lightening more than ever " I obſerved in any other country. Where any oaks grow though encompaſſed by " beeches, I found a conſiderable number of them hollowed and burnt to a coal " within by lightening, though the outward ſhell grew, and bore branches, and " not any of the beeches about them touched by lightening, that I could ſee. The " ſame thing I found as I rode through great woods in Jutland too. At firſt I " thought they had been ſet on fire ſo by poor people or boys to warm them, " till I was aſſured the contrary, and found the like in every wood I came by. " Fruit-trees there are not many; yet, in the country, thoſe, that are, are planted

" by fome few of the great men; the reft by Germans and Hollanders, that are be-
" come inhabitants there, for ornament of their gardens; the reft not being de-
" lighted with that curiofity, or loath to be at the charge, they having great plenty
" of apples brought to their markets by fea, at cheap rates, from Mecklenburg
" and Pomerania; yet the apples, that do grow there, though they are not of very
" delicate tafte raw, yet ferve very well for tarts, and keep very firm and found
" all winter; but the bergamot-pears that grow there are as good as thofe of Hol-
" land, which in my opinion are fomething more delicate than thofe of England.
" Thofe fruit-trees they have are wonderfully loaden with fruit in the feafon, be-
" caufe they never begin to bloffom till the middle of May, when all frofts are
" over. Cherries grow there in reafonable plenty, but fcarce ever grow quite red,
" and are of a four tafte. Apricots grow there too, but are great rarities, be-
" caufe they have no walls to their gardens; the king's own gardens being but
" fenced with deal-boards fet up an end, but thofe apricots are little bigger than
" a man's thumb, though pretty well tafted. Peach-trees I never faw any there;
" fome few vines they have for fhade of an arbor or porch, which bear leaves,
" but never blow toward fruit. Of wild ftrawberry there is fome plenty in the
" woods; but goofeberries never ripen throughly, but ferve well enough for tarts:
" the currants or ribes grow very fair there, they having their plants from Hol-
" land, but never come to due maturity. Damafk or red rofes there grow none;
" but of province-rofes great ftore, which flower from the middle of June to the
" middle of September; and in the feafon great ftore of pretty good tulips are
" brought to the markets; but the flowers, that moft adorn and perfume their
" houfes in May and the beginning of June, are the lilly convallies, which grow
" in great plenty every where at that time. They have moft fort of herbs that
" are fown every fpring; but for mint, they are fain to content themfelves with
" horfe-mint, or cat-mint; for fpear-mint will hardly grow there. For fage they
" have only wormwood-fage, fuch as was brought hither of late years from Scot-
" land for a rarity. At the king's and queen-mother's gardens they keep in the
" ftoves all winter among their exotic plants, as orange and lemon-trees, &c.
" (which with that care will hardly live three years) bays and rofemary-trees,
" gilly-flowers and ftock gilly-flowers, our common fage, and feveral other plants,
" that endure the winter abroad well with us, but are not proof againft the fharp
" long winters there; yet fhort fprigs of rofemary are common enough in the
" markets there, becaufe they fow the feed every fpring. But they have many
" forts of roots, as carrots, turneps, parfnips, fkirrets, which were as good as
" any where in the world; but, above all, the cabbage of that country much
" exceeds that of more fouthern climates. In all the king of Denmark's do-
" minions there grows no wheat, except (as I was told) a little in the ifland of
" Laland; but they have it fupplied at eafy rates from Germany and Poland. Of
" rye, barley, and oats, there is plenty, but the two latter, by reafon of the
" early returns of wets and cold by the end of Auguft, are commonly mowed
" before they are quite turned yellow; and fome years they are fain to dry them
" in ovens. The fheep of that country are moft of them black, and the cattle
" almoft all pied of feveral colours; their flefh is fold very cheap in the market,
" but it is for the moft part lean, they having no good meadows in Zealand;
" there being but one brook in that great ifland, and never a river. There is

" little good fresh water in the island, there being but very few springs. The
" city of Copenhagen is served with water brought from a lake two miles off in
" pipes of bored deal timber; but all the summer long it stinks so, and is so full
" of worms, that it is loathsome to wash one's hands and face in it; and yet
" they have no other water to dress their meat with. Hay is there at reasonable
" rates, but not very good. Of hens and chickens and ducks there is plenty
" enough, but all sold lean in the markets; so of turkeys and geese (pretty fat)
" I never saw greater plenty any where, but they sell none young; no more do
" they of their pigeons, and it is but of late years that they have killed any
" calves. Rabbits there are none in the country, except a few tame ones, and
" the Danes have a natural abhorrency for them, or else the country were very
" proper to breed them. For fresh fish, beside what the Baltic Sea brings almost to
" their doors, as plaice, whitings, flounders, codlings, and excellent soles, and
" great plenty of shrimps, the island of Zealand abounds with great lakes and
" standing pools, supplied with water by the rain falling from the higher grounds,
" which afford them great plenty of carps, pikes, eels, the largest breams and
" perches that ever I saw, fair tenches, which are eaten only by the poorer sorts,
" the rest despising them, because they have a tradition, that at some time of the
" year they are scabby, and have insects like lice found upon them; which
" crosses the English proverb, that says, *as sound as a tench*. The crawfish of
" that country are at least twice as big as ours, and excellent meat: but the
" choicest pond-fish they have is a fish they call karouse, somewhat resembling a
" roach with his red fins, but it is near as big as the largest carps, but much bet-
" ter meat. All the summer time, that country is full of wild fowls, as swans,
" wild geese, duck, teel, widgeon, bald-coot, dive-dappers, sheldrake, moor-
" hen, wood-cock: the open grounds in September so full of green and grey
" plovers, that they rise in flocks of thousands as we pass by them; but by Mi-
" chaelmas there is not one to be seen, they taking their flights, as I suppose, to
" warmer countries; so that all the winter the king's huntsmen have much ado
" to furnish their master's table with a wild duck now and then; for at other
" tables they are not seen till March, when they are out of season, and ill meat.
" The king's forests are full stocked with large red deer, which carry as fair
" heads as any I have seen in England; the penalty being death to kill any of
" them without the king's leave. The woods abound with roe-deer, which are
" much bigger than those of the north of England, and are rather larger than
" prickets with us. Though they are very swift, they make no chace; for, being
" hunted, they quickly endeavour to hide themselves in a bush, and the dogs
" come and tear them to pieces; so the usual way is shooting of them. Every
" ordinary fellow there has the skill, with a leaf in his mouth, to make a call
" for them; and, as soon as they hear the sound, they will come four or five
" jumping toward the noise, and as soon as they dicover the men, endeavour to
" run away again. They are a prohibited game, but, having a placart from that
" king to kill any roe or hare, I did now and then make bold with them. In
" Jutland there are store of wild boars, and in Zealand great plenty of hares;
" in the Amaker island, which is joined to Copenhagen by a bridge, they are as
" plentiful as in a hare warren. I have many times seen ten or a dozen of them
" at one view: in the winter their flew is very grey, and those that are then

" brought to the market from Schonen are perfect white, but both return to their " natural colour in the summer: they are larger much than our hares, but are " neither good to course or hunt. In Denmark they never eat any part of a " roe, hare, or fat stag, but the chine roasted and larded; the rest they give the " dogs. The heathy grounds of that country abound much with juniper and " whortleberries; and the blackbirds, thrushes, and fieldfares, feeding on those " berries and haws, are in the first part of winter the best and fattest meat that " country affords. The first part of their winter, though it begin something " earlier than with us, is wet and cold, but at the rate it is then in England; " and any frost that begins there before Christmas seldom continues long. The " last winter, which was counted the sharpest any man did remember, began but " on the 14th of January; by the 28th the Baltic Sea was frozen quite over, and " store of people began to pass from side to side with hay, corn, and oxen; but " the Sound, where there commonly runs a strong current, between the two " castles, was not quite frozen over till the 8th of February, because there con- " tinued a high wind most time of the frost, which was the reason the great belt " between Zealand and Funen was not quite frozen over all that winter, though " all people accounted it a harder frost than when the late king of Sweden passed " over that belt with his army of horse, foot, cannon, and baggage. On the 19th " of February last I passed over on foot, between Elsenore and Elsenburg, with " a great deal of company with me, and met, not only people passing, as thick " as to a fair, with oxen, and waggons laden, but saw many soldiers dragging " of great stones of near a tun weight a-piece. They commonly making use of " that time of the year to place them under the walls of Cronenburg-Castle, to " help to break the force of the waves, which in stormy weather beats furiously " on them. In several places near the way where we passed, the country people " had made round holes in the ice of about four feet diameter; and, having set " up a skreen of reeds to keep the north wind off them, so spent the whole " day on the ice in fishing at those holes, with lines let down into them with " hooks and baits at the end of them. I bought some good soles of them at " one of the holes; but that, which chiefly made me go out of my way to them, " was, to see the thickness of the ice they had thrown up, which made me won- " der, when I saw it was hardly six inches thick, that it could bear such great " weights as passed over it: but I satisfied myself, that the water, being contigu- " ous to it, did help to sustain it like a float. But, it seems, the frost sinks much " deeper into the earth, than it does into water; for, about the middle of that " great frost, accompanying the body of an English woman, that was to be " buried in a church-yard, I asked the grave-maker how deep he found the frost " did usually penetrate into the ground; he told me a Danish ell and a half, which " amounts to about three feet two inches and a half. But this church-yard was " in the city, and encompassed with houses, where the cold air could not exercise " its utmost power; and, therefore, possibly in the country the frost might sink " yet deeper. However this penetration is remarkably deeper than with us about " London; for, in that great frost, about five years since, not only my gardener, " but several labouring men besides, did assure, that frost did not pierce into " ground, that had been broken up, above six inches, and into grass-ground, " much less. That the frost is much more penetrating there than in England, I " had,

" had, not only the teſtimony of my ſenſe, and the ſeeing ſo large a ſea cryſtal-
" lized, but having, in a room in my houſe above ſtairs, ſeveral baſkets of
" bottles of canary, claret, Nordown-ale; the claret froze firſt, then the Nor-
" down-ale, and at laſt the canary. Their corks were heaved by the ice out of all
" the bottles, and the ice was much more ſpungy than that of common water
" frozen in bottles; but in all thoſe bottles, there was ſome little part of the
" liquor left fluid, which, poured out, was much ſtronger than the drink whence
" it proceeded was at firſt, and when the reſt of the ice was melted by the fire, it
" proved almoſt as inſipid as water. I left all theſe liquors in their bottles, to be
" diſſolved by degrees, when the thaw came; but, after all, they were never
" worth drinking. I ſet bottles of French brandy into the air a whole night to
" freeze, but in the morning there was only ſome few icy particles floating in it:
" but I ſeveral times ſet ſome French brandy in a ſmall ſilver dram-cup to freeze
" in a north window: by morning it was frozen into a very ſpungy ice, and the
" ſpirit and ſtrength of it was gone; what remained being of a very ungrateful
" taſte. This froſt, without any intermiſſion, continued till the 12th of May; at
" what time, going to Elſineur to take order about ſending home my goods by
" ſea, I ſaw the Baltic full of floating iſlands of ice moving towards the Sound;
" and, in the woods I rode through, I could not perceive any thing green. But
" ſo briſk and vigorous is the approach of ſpring in that country, that at my
" return, three days after, the ice was all gone or melted, the trees were full of
" green tender leaves, and nightingales ſinging every where in the woods, which
" ſing there only in May, and not in April, as with us: and, at my firſt arrival
" there, it was a great ſurprizal to find nightingales, when in England I could
" never hear any above forty miles north of London; but yet, in my judgment,
" the nightingales there have not ſo great variety, nor ſuch ſweet notes, as with
" us in England. I ſuppoſe it is no news to any one here to tell them, that
" there is not the leaſt appearance of a tide in the Baltic Sea: but yet the king's
" ſhips of war ſuffer much by it; they never laſting half ſo long as ours, for
" want of a ſpring tide to bring them into a dock to repair them, they having
" no other way to do it but by careening them. But, perchance, every one here
" hath not heard, that, notwithſtanding ſo many freſh rivers empty themſelves
" into that ſea, it is not perceivable, that it hath any motion of its own out-
" ward toward the ocean. There is, it is true, for the moſt part, a ſtrong cur-
" rent, that ſets in or out at the Sound, which is the mouth, or entrance, of the
" Baltic, being, as I have ſaid already, not above four miles broad; but, that
" current is wholly guided and dependent on the courſe of the winds.

" This being what my memory could of a ſudden ſuggeſt to me concerning
" the natural hiſtory of Denmark, I ſhall ceaſe to be any further troubleſome at
" preſent to your lordſhip, and this honourable company."

Upon occaſion of what Mr. Henshaw related of the motion of the Baltic Sea, viz. that notwithſtanding ſo many freſh rivers empty themſelves into that ſea, it is not perceivable, that it hath any motion of its own outwards toward the ocean: and that indeed there is for the moſt part a ſtrong current, that ſets in or out at the Sound, which is the mouth of the Baltic; but that current is wholly guided by

by the courſe of the wind: on occaſion of this remark, Sir WILLIAM PETTY aſked, whether that motion in or out was made with or againſt the wind. And it being anſwered, with the wind; Sir WILLIAM related what he had received from captain SHEERES concerning the motion of the Mediterranean, that for nine months of the year, viz. from about February to Allhollontide in November, the ocean ſets into the Straits' mouth, and that even when the Levant winds moſtly blow againſt that motion; and that for one month, viz. that of November, the ſea ſets out into the ocean, and for the remaining two months of December and January, it is, as it were, dead water.

Mr. OLDENBURG read a letter to him from Monſ. HUYGENS, dated at Paris, 20th February, 1675, N. S. [a] concerning a new pocket watch, which he affirmed to go as faſt as a pendulum, this letter being an explication of his anagram ſent 30th January, viz.

Axis Circuli mobilis affixus in Centro Volutæ ferreæ [b].

Mr. HOOKE ſaid, that divers years ago he had had ſuch an invention; and that actually watches had been made according to the ſame; for which he appealed to the Journal-books, to the *Hiſtory of the Society*, and to ſeveral members of it.

It was ordered, that Monſ. HUYGENS, notwithſtanding, ſhould be thanked for this communication, and informed what had been done here; and what were the cauſes of its want of ſucceſs.

There was ſhewn from prince RUPERT his emboſſed map of the Channel between Normandy, Bretagne, and England, and of both the ſhores.

There was preſented from Mr. LISTER ſome cauk for the vitrifying the whole body of antimony.

February 25. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

The lord biſhop of Saliſbury,	Mr. COLWALL,
Sir JAMES SHAEN,	Mr. HILL,
Sir WILLIAM PETTY,	Mr. OLDENBURG.
Mr. PEPYS,	

The preſident enquiring what anſwers were come in to the printed declaration, Mr. HOOKE delivered a letter of Mr. OUDART, very civilly excuſing himſelf, and alledging reaſons for his late omiſſion, and promiſing compliance with the import of that declaration, as ſoon as he ſhould be able.

[a] Letter-book, vol. vii. p. 130. [b] See Philoſoph. Tranſact. vol. x. n° 118. p. 440. for October, 1675.

Mr.

Mr. Oldenburg gave an account of what Sir John Talbot, Dr. Holder, Mr. Waller, and Mr. Burnet had declared, viz. that the first would himself attend the Society as soon as he could, and see what his arrears were: the second, that he would submit to the import of the declaration, with great expressions of his respect to the Society: the third put it off with an expression of merriment, that he thought it best to forget and forgive one another for what was past, and to begin upon a new score: the fourth desired by Mr. Boyle the Society's patience till he was settled (which he thought he should soon be) and then he would pay his arrears, and sign the bond.

It was ordered, that Mr. Wicks [x] and Mr. Shortgrave [y] carry copies of the printed bond to as many in and about London, as had not yet signed; and to desire their positive resolution for signing or not signing.

Mr. Hooke read before the council Mr. Hoskyns's letter of 26th January, 167$\frac{4}{5}$, importing, that he had made the conveyance from Sir John Bankes, such as he judged safe and sufficient, of the fee-farm rents at Lewes in Sussex; adding, that Sir John Bankes and his trustees must seal, and he or any one of them acknowledge it before a master in chancery, that it might be inrolled. That Mr. Lilly had since promised him, Mr. Hoskyns, to have it ready engrossed for the Thursday following, and to bring to Mr. Hooke an authentic copy of these records, that make out what is due, and out of what lands; that so, if occasion be, the Society may be able to prove their title.

That he had also promised to make known to the council Mr. Thomas Henshaw of Clifford's Inn, who was the person that returned the rent from Lewes; and that Sir John Bankes had promised to the council his conveyances, if they should want them.

It was ordered, that sir John Bankes should be desired to extract out of his conveyances the particular parcels of the lands, out of which these fee-farm rents of twenty-four pounds per annum are payable.

It was ordered likewise, that Mr. Hooke do, as soon as he could, remove the Society's repository and library to the north gallery of Gresham College; and that being done, to perfect the catalogue of both, according to a former order.

Mr. Hooke mentioning, that he had an invention for finding the longitude to a minute of time, or fifteen minutes in the heavens, which he would make out, and render practicable, if a due compensation were to be had for it Sir; James Shaen promised, that he would procure for him either a thousand pounds sterling in a sum, or an hundred and fifty pounds per annum.

Mr. Hooke declaring that he would choose the latter, the council pressed him to draw up articles accordingly, and to put his invention into act.

[x] The clerk of the Society. [y] The operator.

At

At a meeting of the SOCIETY on the fame day,

Dr. GREW read his difcourfes concerning the ftructure of the cortical, ligneous and medullar part of trees, exemplifying it in feveral trees, and reprefenting the fame by figures.

This difcourfe was ordered to be regiftred [z]; and the author was defired to profecute this fubject.

Mr. HOOKE brought in an artificial head refembling china, made in England, of Englifh clay, fo hard and folid, that he faid, that nothing would faften on it, except a diamond; and that it received its polifh in the fire.

Dr. DANIEL COXE fent in a paper concerning the improvement of Cornwall by fea-fand; the reading of which was referred to the next meeting.

March 4. Mr. OLDENBURG prefented a manufcript compofed by Mr. JOHN WEBSTER, and dedicated to the Society, concerning *witchcraft*. The author's defire being, that the Society would give their fenfe of it, they appointed Sir WILLIAM PETTY, Dr. PELL, and Mr. MILLES, to perufe it, and report their opinion.

Dr. VOSSIUS's two Latin difcourfes were read; the one *De apparentibus in Luna Maculis*; the other *De fpeculo Archimedeo*.

Mr. HOOKE gave his thoughts of both, faying, with refpect to the former, that the author's opinion was very ingenious, but did not in all particulars feem to anfwer the phænomena. For though it fhould be granted, that a *lens* did fo invert the object beyond it, as to make a protuberancy appear hollow, and the right fide the left, *&* *vice verfa*; and though we fhould grant, that there is fuch a propriety in the parts of the atmofphere of the moon, extended over and about the fides of the mountains, fo as to be able to produce fuch an inverfion; yet that would not fuffice to make out the appearances: for in the coming on of the light and fhadows upon thofe fpots, which Dr. VOSSIUS efteemed mountains, but we believe cavities, the middlemoft part of the fpot being the moft prominent is not firft enlightened, as it ought to be, according to Dr. VOSSIUS's fuppofition; but the tops and fides of thofe circular ridges, that encompafs the fpot, and are next the fun, are fo; and the fhadow is, as it ought to be, caft regularly upon the other parts of the moon, according to the true rules of fhadow: infomuch that at the beginning the whole middle of the cavity is perfectly dark, as being overfhadowed by the ridge of the funny fide: but as the fun rifes higher, and enlightens the bottom of the cavity, one may in feveral of them difcover, not only divers other leffer cavities or fpots, incompaffed with ridges, as the greater, but alfo feveral fmall hills or hillocks, fuch as Dr. VOSSIUS would fuppofe inverted

[z] Regifter, vol. iv. p. 324. It is printed in Dr. GREW's *Comparative Anatomy of Plants*, book iii.

by

by the refraction of the lunar atmosphere, which appear in their true shapes, and the light and shadow properly posited.

As to the appearance of Teneriffe[a], Mr. HOOKE conceived, that it was no other than that the shadow of the Pike darkened the surface of the sea towards the west, and likewise that part of the vaporous air, that was above the sea, as it may be very often observed, when the air is hazy, the radiations between the clouds and the shadows of the clouds are plainly distinguished in the body of the air. And that this is so seems very probable from the ensuing circumstance in that history[b]; for, upon the rising of the sun a little higher, the said atmosphere thickened into clouds, that covered the surface of the sea and islands adjacent.

Concerning the latter paper of Dr. VOSSIUS, treating of the burning-glass of ARCHIMEDES, Mr. HOOKE declared, that he could not say, whether it were made in the manner described by the Dr. or not: but added, that he was sure, that a speculum made of a parabolical figure would much surpass one of the same size, made up of several specular plains: and that, both in the one and the other, the image of the sun would grow bigger and bigger, (and consequently fainter) according as the focus was farther distant from the said burning-glass: and that therefore, this did not solve that great question about burning-glasses, viz. how to make one of a determinate bigness, that shall burn at any distance assigned.

It was ordered, that Dr. VOSSIUS be thanked for these two discourses, and that they be registered[c]; and that he be desired to give in, at his conveniency, those other matters relating to mechanics and physics, which he intimated in his letter accompanying these discourses.

Mr. OLDENBURG produced a paper sent in by Dr. DANIEL COXE, concerning the improvement of Cornwall by sea-sand[d].

This discourse giving occasion to consider of the cause, that might render this sea-sand more fertilising than other sand, Mr. HOOKE intimated, that the sand being made of the sea water, which in process of time was condensed, it seemed, that this sand not being yet quite fixed, might, by being exposed to the air, and mixed with the rain water, be resolved into sea-water, and so fertilise the ground.

March 11. The person, who should have made a discourse this day, being by urgent occasions detained from the Society, there was read out of the Register a discourse formerly given in by Mr. BOYLE, about shining flesh.

This gave occasion to some hints for a general hypothesis for explaining the nature of light, concerning which Mr. HOOKE gave his thoughts as follow:

[a] See the relation of the Pico Teneriffe in SPRAT's Hist. of the Royal Society, p. 202,203.
[b] Ibid. p 203.
[c] They do not appear in the Register.
[d] It is printed in the Philosoph. Transact. vol. x. n° 113. p. 293. for April, 1675.

That light is a vibrating or tremulous motion in the medium, (which is thence called pellucid) produced from a like motion in the luminous body, after the same manner as sound was then generally explained by a tremulous motion of the medium conveying sound, produced therein by a tremulous motion of the sounding body: and that, as there are produced in sounds several harmonies by proportionate vibrations, so there are produced in light several curious and pleasant colours, by the proportionate and harmonious motions of vibrations intermingled; and as those of the one are sensated by the ear, so those of the other are by the eye.

Mr. HOOKE intimating, that he had formerly brought in a paper concerning light, but not left it to be registred, he was desired to read it again at the next meeting.

He was also desired to have ready for the next meeting, the apparatus necessary for the making Mr. NEWTON's experiments formerly alledged by him, for evincing the truth of his new theory of light and colours, especially since Mr. FRANCIS LINUS had written another letter from Liege to Mr. OLDENBURG, dated 25th February, $167\frac{4}{5}$, N. S. [e], containing assertions directly opposite to those of Mr. NEWTON.

March 18. Mr. OLDENBURG read a letter to himself from Dr. BEAL, dated 8th *March*, $167\frac{4}{5}$, concerning several sorts of cider grafts sent by him for the use of the Society; as also several curious stones.

It was ordered, that Mr. HOWARD, Mr. EVELYN, and Mr. PACKER be desired to take care of ingrafting these grafts.

Mr. OLDENBURG presented to the Society two books, one from Mr. BOYLE, concerning the *Possibility of the Resurrection* [f], containing many philosophical observations and experiments; the other the *Philosophical Transactions* for the year 1674.

Mr. HOOKE read a discourse of his concerning the nature and properties of light [g]; in which were contained several new properties of light, not observed, that he knew of, by optical writers: and those were

1. That there is an inflection of light differing both from refraction and reflection, and seeming to depend upon the unequal density of the constituent parts of the ray, whereby the light is dispersed from the place of condensation, and rarified, or gradually diverged into a quadrant.

2. That this deflection is made towards the superficies of the opacous body perpendicularly.

[e] Letter book, vol. vii. p. 202. It is printed in the Philosoph. Transact. vol. x. n° 121. p. 499. for January, $16\frac{7}{6}$.

[f] It is printed at the end of a discourse published at London, 1675, in 8vo, intitled, *Some Considerations about the Reconcileableness of Reason and Religion. By T. E. a layman.*

[g] See his posthumous works, p. 186—190.

3. That

3. That in this deflection of the rays, those parts of diverged radiation, that are deflected by the greatest angle from the strait or direct radiations, are faintest: those, that are deflected by the least, are the strongest.

4. That rays cutting each other, in one common foramen, do not make the angles *ad verticem* equal.

5. That colours may be made without refraction.

6. That the true bigness of the sun's diameter cannot be taken with common sights.

7. That the same rays of light falling upon the same point of the object will turn into all sorts of colours, only by the various inclination of the object.

8. That colours begin to appear, when two pulses of light are blended so very well, and near together, that the sense takes them for one.

1675. *March* 25. At a meeting of the COUNCIL were present,

The lord viscount BROUNCKER, president,

Sir WILLIAM PETTY,	Mr. HILL,
Dr. WHISTLER,	Mr. OLDENBURG.
Mr. COLWALL,	

Dr. WHISTLER mentioned a proposal to be made to the council for disposing of Chelsea College.

He was desired to receive the proposal in writing for the next meeting of the council.

It was ordered, that the amanuensis and the operator should be urged to greater diligence and care in offering the printed bonds to those, who had not yet signed, between that and the next meeting of the council; and that they should desire every one of those, to whom they offered the bond, to give their positive answer, whether they would sign or not.

At a meeting of the SOCIETY on the same day,

Dr. GREW made a discourse concerning tastes, observing their differences, and drawing some corallaries from thence.

He was desired, both to give this discourse to be registered [h], and to print it.

It was particularly taken notice of, that Dr. GREW had in this discourse inti-

[h] Register, vol. iv. p. 340. It is printed in his *Anatomy of Plants*, p. 279, & seqq.

mated, how the ſpecifical virtues of plants might be diſcerned by their peculiar taſtes.

Mr. HOOKE remarked, that all bodies diſſolvable by the ſaliva are taſtable, and conſequently all bodies taſtleſs, that cannot be diſſolved by the ſaliva.

He ſaid farther, that any body, that is ſaporous, hath ſomething peculiar in its ſtructure, which gives it a peculiar taſte; and that there is probably as great a variation in taſte as there is in colours.

April 1. The SOCIETY did not ſit.

April 8. At a meeting of the COUNCIL were preſent,

The lord viſcount BROUNCKER, preſident,

The earl of Ayleſbury,	Mr. COLWALL,
Sir JOHN BANKES,	Mr. OLDENBURG.
Dr. WHISTLER,	

One Mr. HOLMES offered, in the name of a friend of his, that if the council would let him have a leaſe of the houſe of Chelſea College for thirty years, he would lay out four hundred pounds in repairing that houſe, and pay five pounds a-year for the firſt fifteen years, and ten pound a-year for the remaining fifteen years.

He being aſked, to what uſe it was to be employed, anſwered, that he had no authority from his principal to ſay any thing as to that. But the preſident replying, that the council was deſirous to know that, before they proceeded in the treaty, and that it ſhould go no farther than the council; he ſaid, that he would acquaint his principal therewith.

The preſident mentioned, that the officers of the ordnance intended alſo to make an overture to the council concerning the ſame houſe.

Sir JOHN BANKES delivered the indenture concerning the fee-farm rents of twenty-four pounds per annum in Lewes in Suſſex; which was delivered to Mr. COLWALL to keep.

At a meeting of the SOCIETY on the ſame day,

Sir ROBERT SOUTHWELL read his diſcourſe concerning water, and promiſed to give it in to be regiſtred [f], after he had written it fair. It was as follows:

" An excellent huſbandman or gardener is able to raiſe a livelihood for his " family out of a very little land; that is, out of about an acre to each head, as

[f] Regiſter, vol. iv. p. 300.

" is

"is seen in Holland and Zealand, and as is estimated to be in China: but one, "who hath no such skill, and who must live by gathering of such food as grows "wild, must range over perhaps a hundred times as much ground as the for-"mer, to procure a less splendid and commodious maintenance. In like man-"ner, those of our Society, who have been long versed in philosophical disquisi-"tions, can, out of some few circumstances of a single experiment, make such "an hour's discourse, as shall both profit and please their hearers: but I, who "have no such dexterity, am forced to take for my subject a whole element, a "quarter of the universe, and above half the surface of the habitable world, out "of which to pick up a coarse meal, wherewith to entertain this company; and "therefore the matter of my present discourse shall be *water*.

"If there be four elements, I am content, that water should be one; since "the forming of the world (as it is described by Moses) doth countenance that "opinion; since also many philosophers teach us, that every thing may be dis-"solved *in primam materiam liquidam*; and since we see several herbs will grow "and contract to themselves a hard woody root out of water alone. But being "rather inclined to make but one common element, which is immutable atoms, "I am in the first place to conjecture, of what figures and motions those atoms "are, which do make and constitute water; supposing, according to a late hypo-"thesis, that every atom (like the globe of the earth, like magnets, and indeed "the whole visible world) hath in it three points considerable, namely, two in their "surface, which were called poles, and one within their substance, which hath "been called bias, which biasses have a tendency each to other, and to some com-"mon point without them.

The qualities of water are these:

"1mo. Density; for that it is not easily compressed into a narrower place at one "time than at another.

"2do. Fluidity; for that water poured out upon a level superficies diffuses it-"self also, almost into a physical superficies, or into a very broad body of little "thickness.

"3tio. It is hardenable into ice, and in being so hardened dilateth itself with a "vast strength.

"4to. It is volatile; that is, easily dissipated into invisible parts by heat.

"5to. Small drops of water are disposed to form themselves into a globular "figure.

"To solve all which phænomena, I humbly conceive, that the atoms, whereof "water is made, are globes or globular; that their polar motions are but faint; "that the motions of their biasses one towards another are a little, but not much, "stronger; and the tendencies of them towards the center of the earth, or spe-"cific gravity is not great.

"As

" As for denſity, I conceive, that globes cannot, by any art of laying or pack-" ing them together, be ſtowed in leſs room one way than another; whereas even " cubes, as they may be laid cloſer together than globes, ſo they may alſo be " ſet edge-ways, and corner-ways, ſo as to admit many void ſpaces between " them.

" As for fluidity, if a bag of globes, and another of cubical dyes, were poured " out upon the like level tables, it is manifeſt, that the globes would run further, " and lie leſs in heaps than the cubes, or than bodies of any other figure than " globes.

" 3tio. As for volatility, no bodies have leſs coheſion than globes, which can " touch each other but in points.

" 4to. If glaciation or freezing be a fixing and ſtaying of parts by wedges of " nitre driven in amongſt them, when the atmoſphere is heavy; then it is plain, " that no bodies will more eaſily admit wedges to be driven in amongſt them " than globes: and ſuppoſe, into a veſſel full of globes an acute and long ſharp " angled wedge were driven, that veſſel muſt needs dilate or break, with that " force, which the ingreſs of wedges commonly maketh.

" 5to. Water hath no elaſticity, becauſe the motion of its poles is weak; for " which reaſon alſo it doth not form itſelf ſpontaneouſly into any other figure " than globes, becauſe globes by appoſition will make globes, but the globes, which " water makes, are but ſmall, becauſe the motion of the biaſſes are, according to " our hypotheſis, but weak, and ſuch as their motions towards the center of " the earth doth tear aſunder, and hinder from conglomerating into very great " globes.

" Having ſaid thus much concerning the prime qualities of water from atomi-" cal principles and motion, we come next to the ſenſible differences between ſe-" veral waters, and to the ways of diſcerning between water and water, and be-" tween one liquor or fluid body and another, which are chiefly theſe.

" 1mo. Some water is heavier than others, viz. common water is heavier than " ſpirit of wine, ſea-water heavier than common water; and ſpirit of vitriol, " ſalts, &c. heavier than ſea water; and quick-ſilver the heavieſt of all waters " or liquid bodies.

" 2do. Some waters are more volatile than others; that is to ſay, more eaſily " diſſipable by heat, viz. quickſilver, though heavier than oil of vitriol, is yet " more volatile than it, and ſpirit of wine is more volatile than ſaline ſpirits, in " a far greater proportion than it is lighter.

" 3tio. Some waters, and commonly the lighter waters, are more impregnable " with, and more ſuſceptive of the matter ſteeped in them than others: ſo light

6 " waters

" waters do make better beer than heavier, perhaps becaufe the light waters are " made of greater globes than the heavy and clofe waters, and confequently of " larger interfperfed vacuities; that is to fay, ampler receptacles for other inter- " venient matter. Moreover, we fee, that waters are the beft menftrua for im- " bibing the particles of other bodies; perhaps becaufe water confifting of " globes is on all fides equally open, and fit for fuch admiffions.

" 4to. Some waters diffolve more of the fame falt than others, viz. more of " fugar, allum, vitriol, common falt, &c.

" 5to. Some waters are more abfterfive than others; that is to fay, mingle " themfelves more eafily with faline, gummy, and unctuous fubftances than others; " for all forts of fordes and abftergenda are referrible to thofe heads, efpecially " fuch as are made of the effluvia of mens bodies, and which are wafhed off " from linen. Wherefore foap, or rather abfterfive liquors are made of faline " afhes of oils, and of gums or mucilages compounded together, for fuch a com- " pofition will abfterge or cleanfe almoft every thing; for we fee, that water joins " itfelf with flimes and mucilages; oils join themfelves with greafe; thin and hot " oils wafh away thicker and cold oils; as fpirit of turpentine wafheth painters " colours; and acid liquors, as juice of lemons, wafheth the vitriol of ink from " linen, and the liquor of tartar wafheth away the blacknefs from ink itfelf.

" 6to. Some waters do harden the things, that are boiled in them, by ftiffening " and reftringing the parts of the fame; and others foften and intenerate the matters " foaked in them.

" 7mo. Some waters coagulate milk, and caufe feparation of heterogeneous " parts more than others.

" 8vo. Some diaphanous waters, by mixtures, lofe their tranfparency, and fome " acquire colour without lofs of their tranfparency.

" 9. Some waters are apt to putrify and to produce animalcula more than " others.

" 10. Some waters are apt to ferment and precipitate more than others.

" 11. Some waters are more fweet and nutritive.

" 12. Some waters promote the growth of plants more than others.

" 13. Fifhes live and thrive better in fome waters than in others, as fome airs " do more favour the health of man than others.

" 14. Some waters break forth cold, fome hot, out of the earth.

" 15. Some waters rife higher into clouds by the exhalation of the fun, than " others.

" 16. Some

" 16. Some waters are more diuretical and diaphoretical than others.

" 17. Some waters are more inflammable and ſpirituous than others.

" 18. Some are more ſtupifying, intoxicating, and inebriating than others.

" 19. Some are more apt to freeze, and the ice of ſome is more denſe and uni-" form than that of others.

" 20. Some waters have their peculiar and ſpecific qualities differing from " others; of which (being infinite) I forbear to ſpeak.

" Having briefly touched upon the intrinſic conſtitution and ſenſible differences " of waters, I ſhall next (perhaps with too great licentiouſneſs) paſs to the con-" ſideration of other difference and diſtinctions of water, more groſs indeed, " but not leſs uſeful in human affairs; to wit, I ſhall conſider the waters of the " world, as divided into ſea and rivers, and the ſea divided into coaſts, ſhores, bays, " roads, ports, havens, and creeks.

" 2do. I ſhall, in ſome meaſure, divide the ſeas into the ſeas of ſeveral coun-" tries, as diſtinct from one another, and from the ocean; by which I mean the " ſea indifferently belonging to all countries and ſtates.

" As for the freſh waters, we ſhall divide them into lakes and rivers; and brooks " and rivers into their heads, mouths, and ſources:

" For all theſe diſtinctions are of great uſe in political matters, if not in phyſi-" cal; and I hope you will ſuffer me, whoſe ordinary employment partakes " more of the former than of the latter, to piece up my diſcourſe of both; for " without ſuch licenſe and encouragement I could not have appeared at all in " this undertaking.

" Wherefore I ſay, that water, viz. navigable water, is commonly divided in-" to ſea and rivers, or rather into inland and outland, as well as into freſh and " ſalt-waters. Therefore ſuppoſing the ſea did belong of right unto A, and the " rivers unto B, it ſeems neceſſary, for the peace of mankind, that philoſophers " ſhould aſſiſt the world, and particularly help A and B with ſuch definitions, as " are neceſſary for ſuch their peace. In order whereunto I ſhall firſt premiſe the dif-" ficulties of that work itſelf; for although there be nothing more common than " in talk to diſtinguiſh between ſeas and freſh-water rivers, yet when we come to " draw lines from one permanent and conſpicuous mark of the one ſide of ſuch " waters, to the like mark on the other ſide of the ſame, I do not know, that " there are any rules in nature for doing thereof, that is, ſuch as may oblige " the whole world. Nor are there ſo much as ſtatutes and agreements of people " for determining the ſame: nor hath ever the navigating nation of England " ſet ſuch marks, ſo much as on our own two greateſt rivers, the Thames and " the Severne. As for example, if we would diſtinguiſh the ſea from rivers by " ſaltneſs,

" 1mo. We ſhall find no two taſtes to agree upon that ſign. 2. The ſalt " waters of the ſea intrude further upon the freſh rivers of the land at one time " than another. 3. There may be both ſalt, or ſaltiſh rivers, and alſo freſh ſeas " or lakes in the world, enough to diſable this means of a diſtinguiſhment, eſpe- " cially when matters of great value and importance ſhall depend thereupon.

" Again, if we endeavour this diſtinction by the limits of ebbing, and flow- " ing, accompting all waters, which have their reciprocal motion to be ſea, 1. " We ſhall find waters called ſeas, wherein thoſe motions are very obſcure and " ſmall. 2. Waters ebb and flow differently, according to wind and other ac- " cidents, beſides their monthly and annual differences; beſides thoſe more ſlow " changes, where the ſea gains on one ſhore, and loſes on the oppoſite.

" Laſtly, if we would go about this work by narrowneſs or depth, we ſhall find " very ſalt waters to paſs through very narrow fretums, and ſalt waters to be very " diffuſe and fordable; and on the other hand, there are waters perfectly freſh, " which be very broad and deep, beſides the differences of paſſableneſs, which " ariſe from the ſides and bottoms of the water in queſtion.

" Now, if we can find no rules in nature, but muſt fly to ſtatutes, charters, " and cuſtoms, the ſame can only oblige the few, which made and accepted them, " not the whole world; and conſequently cannot prevent wars and blood between " the ſeveral nations, that find it their intereſt to contend about it.

" Moreover, as it is uſual to talk of ſeas and rivers, as was diſtinguiſhed, ſo " Mare Hibernicum, Mare Britanicum, Mare Germanicum, frankly inſerted; " and our laws do make mention of things done inter or intra quatuor maria. " We do alſo find mention of the Deucaledonian and Atlantic Oceans, &c. but " it appears not by the conſent of nations or princes. It is to be found on re- " cord remaining with all parties intended between each other, that there are " permanent and conſpicuous marks agreed upon on each ſide of the water, " between which, as the terminus a quo, and ad quem, where thoſe lines of de- " terminations ſhould be drawn, viz. from what viſible rock at Dover, to what " like mark about Calais, the line may be drawn, which divides the Britain from " the Germain Sea; from what point in Wales and Scotland, to what points in " the ſouth and north parts of Ireland reſpectively, the two lines ſhall be drawn, " which, with the ſhores on each ſide, doth incloſe the Mare Hibernicum. Much " leſs do I find, what lines diſtinguiſh the Britiſh Sea from the Weſtern Ocean, " or the German from the Deucaledonian, &c. or, if ſuch lines were fixed, can " I conceive how, out of the ſight of land, one could certainly know, when he is " within or without them, ſo as to determine the controverſy, whether a ſhip of " an hundred thouſand pounds value were prize or not, viz. if ſhe were prize " taken within, and not if taken without, the lines of fixed termination: for I " can think but of three ways of doing the ſame, the firſt whereof is by latitudes " and longitudes; the former whereof is not knowable at ſea within leſs than " about twenty Engliſh miles, and that too but when obſervations may be taken;

" and the latter is scarce knowable at all, otherwise than by running glasses, and " clocks, which do not yet go at sea sufficiently for that purpose.

" The second way is by soundings, whereby the depth and nature of the ground " is discovered: but forasmuch as there may be plains in the bottom of the sea " of many miles in length, as also sudden and frequent inequalities in the same, " no certainty can be hoped for from that help.

" The last is what men call the dead reckoning by rhombs and distances pro- " tracted on the card: but, forasmuch as no man can steer nearer than to half a " point; (forasmuch as every ship's course is disturbed by tides, currents, and " leeward-way) forasmuch as the log and line is no certain measure of dis- " tances; and for that the variation of the needle is to be observed in sailing of " long runs in several parts of the world; forasmuch as charts are not enough, or " equally true; and lastly, for that a long reckoning shall, by its accumulation " of errors, differ much in truth from a short one: I say, for all these reasons, " the dead reckoning is not to be relied upon, where an hundred miles is in " question; for either part will appeal to blood and blows, rather than acquiesce " in the finest conjectures, when such a wager lies at stake. It is true, such con- " troversies might be determined by the medium of the reckoning, made by " both parties; or by the real and true reckoning of the superior party: but this " is not a rule in nature, but must depend upon conquest or consent.

" We have said, that neither seas from rivers, seas from seas, nor seas from " oceans, can be distinguished by natural marks. We further say, that lands " from shores, and shores from coasts, are not distinguished by much more cer- " tain and satisfactory means: for, first, as for the shore, I take it to be ground " reciprocally shewing itself, and appearing both as land and sea, that is to say, " a girdle of ground comprehended between the high and low water marks of " an ebbing and flowing sea. Now, how this girdle straitens and widens itself " every day, by the interposition of winds and land-floods, by the new and full " moon, by the seasons of the year, by the firmness and looseness of the earth " upon the shore, and from some obstruse causes also, is well known to every ob- " server. Nevertheless, the limitation of shores is much more certain than that " of coasts, where certainty is more desirable and needful; for I take a coast to " be that part of the sea without the low-water-mark to seaward, which by some " kind of natural right belongs to the paralelled and adjacent country washed by " it: as for example, our endeavour now is to answer the question, how many " miles broad is the coast of England, or of any part of it, viz. of Dorsetshire, " Devonshire, &c.?

" To which question I offer and propose the several following answers, viz. " 1. The coast of Dorsetshire extends from low-water-mark unto half the shortest " line between the shore of Dorsetshire and the shore of opposite France.

" 2. It is the distance from the shore, where the convexity of the sea terminates the " sight of one, that standeth on the ground, or of an eye six feet above the ground.

" 3. The

" 3. The diſtances, at which the biggeſt ſhip (ſuppoſe of an hundred tuns) can " be ſeen from the ſhore.

" 4. The diſtances, at which, from the talleſt ſhip, the next land may be ſeen.

" 5. The diſtance, unto which an open boat of certain dimenſions dares ordina-" rily go a fiſhing into the ſea.

" 6. The diſtance from the ſhore into the ſea, at which the beſt gun can carry " or ſhoot with effect.

" 7. The like diſtance, with reſpect to a muſket, or the biggeſt killing inſtru-" ment, that the ſtrength of a man can wield or uſe.

" 8. The diſtance, at which from ſea a man, or other the biggeſt animal or " thing, can be ſeen to move on the ſhore.

" 9. The diſtance a man on horſeback can ride from low-water-mark into " the ſea, and throw a dart, ſhoot an arrow, or bullet, out of ſuch a gun as he " can carry thither.

" 10. The diſtance from the ſhore, until no ground can be ſtruck by an ordi-" nary deep ſea-lead, ſuppoſe of an hundred fathom; all which diſtances and " dimenſions of a coaſt will be longer and ſhorter, according to ſeveral accidents " and circumſtances eaſily conceivable without further mention.

" So what is meant by the ſhore or coaſt of France, upon which an Engliſh-" man may not fiſh without breach of peace, is unknown to me from any thing " I ever yet read or heard diſcourſed, even by perſons concerned as far as blood " in thoſe matters; and it is not yet clearly demonſtrable, were the caſe put " vice verſa. I have met with a paper ſeeming to be a declaration, or intended " declaration, from his late majeſty of bleſſed memory, made in council, as I " gueſs, between the years 1630, and 1640, wherein are theſe words, viz.

" *And therefore, to avoid all difficulties, and colour of controverſies, that may be* " *ſtirred concerning the bounds and extent, wherein his majeſty now profeſſeth to yield* " *peace and ſecurity to his friends and neighbours deſiring the ſame, his majeſty pur-*" *poſeth to ſend plats of thoſe limits to be affixed in the moſt public places of his* " *chiefeſt ſea-towns and harbours*, &c.

" Now, in the maps and plats above-mentioned, I ſuppoſe the difficulties here " lamented are remedied: wherefore I ſhall ſearch for the ſame plats, and, if to " be found, produce them; but if not, I ſhall then offer my thoughts to the " ſame purpoſe.

" I have here ſet forth the difficulties of diſtinguiſhing between navigable " waters, as aforeſaid: and now, by way of remedy, in caſe thoſe directive plats,

"last mentioned, intended at least to be set forth by the best skill and authority, "should not be found, I shall only offer, as an expedient for the present, the "following lemmas, viz.

"1. That an enclosure may be made of those four seas, which are com- "monly deemed part and parcel of the English empire, by sensible and prac- "ticable marks, for an inconsiderable charge, viz. for within one hundredth part "of the yearly charge, which the sea forces of England have commonly cost, "and that so, as no vessel may go in and out of the same without notice, which, "in brief, is to say, that there is *mare clausible*, if not *mare clausum*.

"2. That it is for the advantage of all princes and states, who do pretend "to any share in the dominion of the seas so inclosed, wholly to quit the same, "and transfer their whole pretences to some one of their number.

"3. That the English Empire, besides their ancient rights by custom, con- "quest, and concessions, are the best qualified, even in nature, to receive and "administer this power; and that for the reasons following, which, because they "are natural, I here bring in, wholly declining the second lemma, as purely "political, and suspending the first till I find there is no better expedient already "extant; for, it being a matter of art, it might have fitted this presence well "enough.

"I say, the natural reasons for our sovereignty of the seas are these, viz. 1. Sup- "posing, for instance and illustration sake, the *mare clausum* we intend, to be the "seas comprehended within a line, beginning but even at the isle of Scilly, and "passing thence to Cape Clear in Ireland, thence to the Dursyes, and thence "again to the north-westermost part of Ireland, thence by the Hebrides west- "ward to Scotland, thence to Cape Van Staten, then to the Naze of Norway, "thence to the next land of Jutland, thence to the Elb's mouth, thence by "Holland, Zeland, and Flanders, to Calais, thence to Heysant in Britanny, and "thence to Scilly where we began: I say, First, that the king of England hath "thrice as much shore, as the king of France, Spain, Denmark, the states of "Holland, with the towns of Hamburg, Embden, and Bremen, put all toge- "ther, do possess; and, though the Baltic Seas were added to the inclosure last "mentioned (the Sinus Bodicus excluded, lying without the latitude of Cape Van "Staten) the king would have as much shore as all the princes and states afore- "mentioned (adding the king of Sweden, with the elector of Brandenburg, the "towns of Lubeck and Dantick) also have: nay, if the Bay of Biscay were also "added as a third enclosure to the other two, the king of England hath still "more shore within all the said three enclosures taken as one, than any two of "the aforementioned princes, who have the most within the same: all which "may be seen by the maps.

2. The isles of Great Britain and Ireland do lie about the middle of the line of "trade, extending itself from Archangel in Russia, round about by Ireland to "Tangier, and through the whole Mediterranean Sea to Constantinople. More- "over,

" over, Ireland ſtands in the face of the New American world, which doth al-
" ready, and will every day, more and more beget a vaſt trade; nor have France
" Spain, and Portugal, which alſo have the ſame aſpect to the new world, half
" ſo many ports and conveniencies for the new world's trade, as the king of
" England's countries have.

" 3. About three quarters of all ſhips of the ſeveral European nations trading
" to the Eaſt Indies, Guinea, the Streights, and America, muſt paſs, in their
" voyages thither, between Scilly and Heyſant, or between Scotland and Nor-
" way; all which paſſages we ſuppoſed may be encloſed as aforeſaid, and as ſhall
" hereafter be better explained. Moreover, the great magazine of naval provi-
" ſions, as timber, plank, boards, iron, hemp, pitch, maſts, and tar, as alſo of
" corn, muſt have vent through the ſame paſſages.

" 4. The great fiſheries of the old world, particularly that of herrings, (the
" Indies of the Hollanders) is within the chief of theſe three encloſures, and
" within the ſame is the greateſt market and conſumption of all the French
" bulky commodities, of wine, brandy, ſalt, paper, and their fruits. Moreover,
" againſt this encloſure are the greateſt fiſheries of the new world, namely about
" Newfoundland.

" And, laſtly, through the aforementioned paſſage muſt the Greenland and
" Muſcovy trade be managed.

" 5. The king of England and his ſubjects have already more ſhipping of war
" and trade, than any two of the princes aforementioned, the ſtates of Holland
" only excepted, who have little other wealth: but he hath four times as many
" ſubjects as that ſtate hath, who, when they find it their intereſt to look after the
" dominion of the ſeas, may alſo bear the ſame proportion to the Hollanders,
" even in naval ſtrength alſo.

" 6. It hath been ſhewn by a great obſerver, that the king of France is, or
" may be, ſuperior to the king of Spain in naval force; but, withall, the king-
" dom of France is under natural and perpetual impediments of ever being as
" powerful at ſea as either the Engliſh or Hollanders now are.

" 7. The ſituation of Denmark and Sweden is ſuch, in compariſon of Great
" Britain and Ireland, with reſpect to this dominion, that the Engliſh can do
" more towards it with two, than they can do with four. Nor are the Danes and
" Swedes any thing as to this matter, unleſs they could be always as one, which
" the likeneſs of their intereſt will ſeldom ſuffer them to be.

" 8. Great Britain and Ireland are under an abſolute neceſſity to be ſtrong in
" ſhipping and ſea ſoldiers, to defend themſelves from foreign invaſion; which
" ſoldiers are alſo held beſt for ſuppreſſing any domeſtic inſurrections amongſt
" themſelves. Now, ſixty thouſand men at ſea is near treble the force, that ever
" any enemy appeared with againſt England, and yet may be maintained with

" one

" one ſixteenth part of the expence of the king of England's ſubjects: the raiſ-
" ing of which one ſixteenth part can be no ſenſible calamity upon his ſubjects,
" ſince few can diſcern the quantity and quality of the commodities they ſpend
" and uſe, within one ſixteenth part of the ſame.

" Wherefore if, as it was before ſaid, it be the intereſt of all princes and ſtates,
" who have ſhare and ſhore within theſe encloſures, to transfer their power to
" ſome one of their number, to prevent *bellum omnium contra omnes* concern-
" ing the ſame: And, ſince the king of England hath already ſo fair, ſo pro-
" bable, and ſo ancient, a claim to this power, which neither he nor his ſub-
" jects will ever quietly part with; I conceive, that it is the intereſt of the ſaid
" princes, for the additional natural arguments above mentioned, to reſign and
" confirm the ſaid power and authority unto him, without further trouble, and
" eſpecially ſince his people, knowing their rights and intereſts therein, can other-
" wiſe, if occaſion were, compel them thereunto.

" We have hitherto ſpoken of the differences of navigable waters: we ſhall
" in the next place purſue to define and diſtinguiſh ſome other particulars relating
" to the premiſes, as followeth: in order whereunto we next ſay, that

" A river is a channel, whereby freſh waters riſing out of ſprings and collected
" rain waters, return into the ſea conſtantly and continually: whereas brooks are
" not only ſmall rivers, but rather channels, which run with waters, not con-
" ſtantly, but only at ſome times and ſeaſons. The mouth of a river is the
" place, where the river joins with ſea; and the head of a river is ſometimes
" taken for the ſmalleſt ſource and beginning of it; but ſometimes for ſome
" headland, even without the mouth of the ſame: as for example, an head-land
" near Havre de Grace in France is called the Seine head. Nor is it incongru-
" ous to ſay, that the head and the mouth ſhould be near, if not within, each
" other: whereas the beginning of that river and its head in ſome ſenſe is many
" leagues ſouthward of Paris. I mention this of names, becauſe it is of great
" concernment in the ſettling of new colonies in America, the boundaries whereof
" are, for the moſt part, rivers; and it is fit it be very clear what is meant by
" the head of river: as for example, there is now, or was very lately a con-
" troverſy depending upon this very point, whereby the Boſtoners in New Eng-
" land claim the provinces of Hampſhire and Mayne to be under the juriſdiction
" of their province, while yet there are two diſtinct colonies and goverments
" independent from Boſton, according to the various acception of the word *head*
" *of a river* in the reſpective patents, whereby they are granted; for, if the
" breadth of Boſton province be the diſtance between the two parallels paſſing by
" the ſmall inland beginnings of the two rivers, Charles and Merimac, then the
" three abovementioned province are but one.

" But if by *head* be meant certain points near the mouths of thoſe two rivers,
" then are they three; which is a vaſt difference, and toucheth eſtates, and might
" touch the lives of many concerned perſons.

" An

" An haven or harbour muſt have thoſe ſeveral following qualifications, viz. " 1. Stiff ground to hold anchors. 2. Free from rocks or ſharp ſtones, which cut " cables. 3. The ground ſoft and ooſy. 4. Either water enough to ride afloat " at low water, or elſe the ground to be of eaſy declivity, that when a veſſel " begins to ground upon the ebb, ſhe may be ſoon faſtened in ſhallower water, " and when a veſſel floats upon the flood, ſhe may be ſoon hauld out into deeper " water, to prevent knocking by the riſing and falling of the ſea waves; whence " it happens, that a ſhip becalmed on large flats, ſuch as are between Graveſend " and the Downs, is in the ſame danger, as if ſhe were taken with a ſtorm; for " not being able to move forward, ſhe muſt come aground in the ebb, and if the " ſea grow when ſhe comes to float again, ſhe may be beaten to pieces, having " no deep water to be hauled into.

" 5. A harbour muſt have head-lands to break the violent influences of the ſea, " with what wind ſoever they be forced in; and ſuch an one is called landlocked.

" 6. The lands muſt not be ſo ſituate for hight as to gather great quantities " or guſts of wind, called flaws, coming on a ſudden.

" 7. The water muſt not be too deep, perhaps not above eight fathom; for " in ſuch, the cable making an acute angle with the ground and ſurface of the " ſea, prevents the veſſel's head being pulled under water, as would be, where the " cable is more upright and perpendicular, and where the difference of the riſing " of the ſea is greateſt.

" A creek is a ſmall harbour, or harbour for ſmaller veſſels.

" A port is an harbour ſo ſituate, as that ſhips may be protected within, and " into which none can paſs in or out without leave of the land; and a place " within, which a ſmall boat may go a-ſhore at all times.

" A road is a kind of half harbour, where is good anchorage always, but not " protection from all winds at all times.

" What thoſe diſtricts and precincts of ſea be, which are commonly called the " king's chambers, appear not to be publickly aſcertained; but I gueſs them to " be a kind of ſegment of a circular ſpace, where the land is the arch, and the " chord is a line drawn between two head-lands within ken of each other.

" The principal uſe of the ſea and rivers is for eaſier carriage of commodities: " for we ſee, that a tun of twenty hundred of ſeacoal is brought near three " hundred miles for about four ſhillings; or at ſix ſhillings and ſix pence per " chalder, which is in weight about thirty-three hundred: but the land-carriage " of the ſame by waggon would be about fifteen pounds, viz. ſeventy-five times " as much, and on horſeback above an hundred times as much; horſe-carriage " being in proportion to wheel-carriage as three to two: therefore, we may ſafely " ſay, that the carriage of coals from Newcaſtle by wheels would be intrinſically

" ſixty

" fixty times dearer than the prefent fea-carriage; but the fea-carriage of coals " from London to the Land's-End of England would be treble of what the fame " is from Newcaftle, viz. about twenty fhillings per ton, from whence, by the " way, may be noted, that the freight of fhipping fwells chiefly from their at- " tendances and waiting on their trade, not on the very value of the labour, " and when they neither ftay for loading or unloading. Wherefore, more com- " monly and practically fpeaking, the ordinary proportion between fhip and " wheel-carriage is about one to twenty; and of inland water-carriage to wheel- " carriage, as one to twelve. Wherefore we may generally fay, that land to " water-carriage is as about fixteen to one. Now, if the longeft land carriage " in England do coft about three half-pence per pound, and the middle rate be " three farthings; and, that nine parts of ten of all goods imported and exported " is not worth four pence per pound, one with another, fuch as falts, wines, " corn, ftaves, timber, board, fruits, iron, lead, &c. it follows, that the diffe- " rence between land and water-carriage is greater, than the gain, which any " merchant hopes to make; and thence it comes to pafs, that the place, which is " moft commodious for water-carriage, has vaft advantages over all others for " gain by trade. And fuch a country is Holland, whereof no part is one quarter " of a mile from fome navigable water, navigable at all times and by many " ways, viz. by conts or poles within board, by draught of men or horfes from " the fhore, by oars and fails, without the impediments of tides or currents, " land-floods, &c.

" From thefe confiderations we come to frame a fcale or meafure, whereby to " determine, how much any country is better, one than another, for water-car- " riage, fuppofing, that all the inlands are rivered alike: and this is done by " determining how far any country, and all its parts at a medium, are diftant " from the fea. In order to which, 1. compute the fquares of a mile in fide, " which the fuperficies of any country doth contain: next, compute the miles of " the perimeter fhore belonging to the fame: then dividing the fquares of the " fuperficies by the miles of the fhore, the quotient will give the breadth of the " oblong, or parallellogram, which the faid country is equal unto in point of " adjacency to the fea; half which quotient, or breadth, is the middle diftance " fought for: a collection of which diftances will make a fcale, wherein the con- " veniency of each country for carriage may be computed, according to which " fcale, as I remember, France is eighty-fix, England twenty-four, and Ireland " fifteen, miles diftance from the fea.

" From hence alfo may be drawn another ufeful rule to know, of what ad- " vantage it is to plant or preferve timber in England or Ireland or any where " elfe; for, in Ireland, for example, the price of timber can be, 1. but fifteen " miles land-carriage, or ten fhillings per ton. 2. Freight of the fame from the " place, where it grows moft plentifully, fuppofe Norway, which may be from " twelve to twenty more fhillings, together with the wood-leave, hewing and put- " ting on board, which feldom, in woody fhores, amounts to ten fhillings more: " from whence it follows, that timber in Ireland will never be but about forty fhil- " lings per ton, even although not a ftick grew in the country; and confequently,

" this

" this being known, one may compute, whether the lands and labour of Ireland " can be applied to more advantage of other kind, than by the planting and " culture of timber.

" These considerations force me to say something of navigable rivers, and of " making way for more inland water-carriage, upon which account I briefly say:

" 1. That a perch of river five feet deep, and about sixteen feet broad, may " be made at four pence per yard cube, for less than twenty shillings per perch, " where the ground is fit to hold water, and is not too contumacious by reason " of rocks and other impediments; so that a mile of such excavation may be " had for about three hundred pounds.

" 2. That in most cases it were better and cheaper to make new channels of " just depths and breadths, than even to bank the rivers already in being, and to " repair all the inequalities of them, making use of the water of the old natu- " ral rivers, which is to be let into the new ones. And hereunto we offer.

" 3. That these new channels need be no broader than that one boat may " pass, which may be, if, at every quarter or half mile's end, a small dock were " added to the side of the channel, into which, upon meeting of boats, which " cannot pass by side by side, one of them might put in till the other be past by; " or, without these docks, the same thing may be performed by appointing " certain times for descending, and other like times for ascending, of boats " to pass.

" 4. Where the beginnings of rivers do lie higher one than another, or where " several rivers do rise out of one great mountain in the several hights of it, " there must be fitting contrivances to join them, other than the locks and sluices " now in use, which are impracticable, where the difference is above twenty feet, " or thereabouts: I say, provision may be made to comply with a difference of " about one hundred feet.

" 5. In order to the perfecting of this work, such contrivances must be had, " as to furnish any channels fit for the purpose, which of itself has no water at " all, with sufficient water from elsewhere.

" 6. A necessary preparation to this work is a map of the country, expressing, " not only the plain or level thereof, but also all the inequalities and diversities " of its surface as to figure and matter, with the mean quantity of water, which " is in every river of such country, and with the mean quantity, which passes " through it in an hour, or any other assigned space or time.

" 7. To know, whether navigabling of rivers would be a thing of profit, a " computation must be made, which is most easy, of the annual charge of land- " carriage to and from London, and between perhaps twenty other emporia of

" the kingdom; as alſo an eſtimate of the numbers travelling to and fro between " thoſe places.

" 8. There muſt be a law for purchaſing all ground fit for this purpoſe at " moderate rates, and for ſending all malefactors not deſerving death, and all idle " perſons, to this work.

" Having premiſed theſe eight particulars to encourage this work, I ſhall " bring one computation, which, without the others above mentioned, is of it- " ſelf ſufficient to ſupport this deſign; which computation conſiſts of theſe fol- " lowing branches, viz. 1. That but one year of three is time of war. 2. That " the intrinſic value of Newcaſtle coals is not above fifteen ſhillings per chal- " dron, under which rate, within theſe forty years, they have been boughtand " ſold at London. 3. That in time of war they are at a medium ſold for forty- " five ſhillings a chaldron. 4. That about three hundred thouſand chaldron are " yearly brought into the port of London.

" From all which it follows, that London in the years of war pays four hun- " dred and fifty thouſand pounds extraordinary for coals, that is, the one third " part of the ſame at a medium in times of war and peace, which is one hun- " dred and fifty thouſand pounds per annum. Now, if the purchaſing of a per- " petual convenience, worth one hundred and fifty thouſand pounds per annum, " be worth as many years purchaſe as land, the value of this convenience, at " fifteen years purchaſe, is worth two millions and two hundred and fifty thouſand " pounds.

" Moreover it is certain, that there are coals ſomewhere within one hundred " miles of London; and, if a navigable channel could be made, as aforeſaid, be- " tween ſuch place and London, at the rate of three hundred pounds per mile, " then the purchaſe of this conveniency would coſt but thirty thouſand pounds; " or, if you pleaſe to comprehend all accidents, ten times as much, viz. three " hundred thouſand pounds: yet ſuch charge is not the one ſeventh part of the " two millions two hundred and fifty thouſand pounds, above mentioned.

" The objection againſt this deſign is an opinion, that it is better for England " and London to fetch coals from Newcaſtle, than to have them at Blackheath. " Now, it becoming not this place to ramble too much out of the bounds of " natural philoſophy, I take the boldneſs to ſay, that ſuch aſſertion is abſurd, and " infers, that it were better fetch cinnamon from the Eaſt Indies to heat our " ovens in England, than to uſe furz or faggots for the ſame.

" To conclude this matter, I ſay, to the beſt of my underſtanding, that if one " thouſand miles of new navigable channels were made in fitting and paſſ- " able places of England, the conveniencies ariſing from the ſame could not " coſt three years purchaſe, beſides the employing and puniſhing of all idle " perſons.

" I

" I ſay further, that, if this were done, the ports of England would be fewer " and better, and the kingdom more ſecure from invaſion, and interruption of " trade, and alſo from the diſtractions and tumults, which may happen among " poor and mutinous people upon the want of commodities of neceſſary and " daily uſe. I am ſenſible, that what I have here ſaid is rambling and extrava- " gant, and a ſign of my want of natural philoſophy. I ſhall now therefore " return, as well as I can, and give you my thoughts of a few other miſcellany " matters relating to water, of which you are to expect no coherence.

" The firſt whereof is, that ſomewhere about Staffordſhire is the higheſt " ground of England, and the place, as many do think, of greateſt longevity. " That it is the latter, we muſt expect the proof from thoſe ſcales of ſalubrity " and longevity not long ſince propounded by a member of this Society; and as " to the former, which is the highernefs of the land, it is viſible from the in- " ſpection of any map of England; for therein it will appear, that Glouceſter is " near of equal hight with the ſources of thoſe rivers, which make the Thames; " and that Glouceſter, ſituate towards the mouth of the Severn, is lower than " the ſources of the Severn, which are in Staffordſhire. 2. The ſources of the " Humber and Trent are not far from the ſame place. 3. The rivers, which " run from about the ſame place into the Iriſh Seas, are ſhort and ſwift, which " denotes the ſame aſſertion of the hight of that place.

" The next of my Miſcellanies ſhall be of land floods.

" We often find, that upon news of very ordinary rains, we withall hear now " and then of very great land-floods, where we little expect them; the reaſon " of which ſeeming wonder I take to be this; 1. Suppoſing rain or ſnow " (which is accumulate rain) to fall, not univerſally, but on ſome certain ſcope " or area of ground, ſuppoſe of four miles ſquare, or of four miles diameter; " it is apparent, that, if this rain or ſnow fall upon a concave piece of ground " of that dimenſion, of the ſhape of a baſon, or rather of a tunnel, having a vent " in its bottom, there muſt be a great flood, for that all the waters falling on " the whole muſt vent at ſome point-like place: whereas, if the ſame ſcope " of ground were a convex, the rain would fall and diſperſe itſelf every way, " and have a vent of twelve miles about, which, in the other caſe, was but a " point, or ſmall ſcope, perhaps of a quarter of a mile. The two caſes, which I " have put, are the two extreams of this notion; but as the ſhape of the land " partakes more of one or of the other of theſe extreams, ſo the effect will be. " Now, the ſudden thaws of great accumulations of ſnow, joined with great " rains, is but a common cauſe of land-floods: but what I have here ſaid is " intended to ſolve the anomalous appearing of land floods, beſides expectation.

" And now, perhaps, it will not ſeem leſs wandering than the reſt of this " diſcourſe, if we get up into the air, and conſider the way of birds over great " ſeas, which is the 3d of my miſcellanies.

" 1. That birds do paſs over great ſeas, and do readily and ordinarily find " their way over them, is well known; nor is it doubted, that ſeveral birds, " whoſe eyes are but the hundredth part in magnitude to the eye of a man or " ox, can ſee much further than either; although we find, that long teleſcopes, " and microſcopes too, do beſt perform their ſeveral ends of viſion.

" 2. Birds, mounting themſelves higher into the air, can beſt evade the impe- " diments of ſight, depending upon the convexity of the earth: yet I do not " apprehend, how the betterneſs of their ſight, or the highneſs of their proſpect, " ſhould give them the advantages we admire, of finding their ways over ſeas " of many kens broad, counting a ken to be about fifteen miles: I ſay, of ſo " many kens as they can fly over, whilſt they can want ſleep, or ſuch food and " other neceſſaries, as the land only affords them. Wherefore, ſtating the caſe, " or ſuppoſing that birds can find their way over ſeas where they cannot ſee from " ſhore to ſhore, the queſtion is, by what marks they direct themſelves?

" In anſwer whereunto I firſt conclude, thoſe marks are permanent; for other- " wiſe they could not make uſe of them at certain ſeaſons, and when the air " through which they paſs may be under great variety of winds and clouds. " It cannot be by the ſea water alone, for that is liable to much variety. I " conclude therefore, that it muſt be by the ground or bottom of the ſea ap- " pearing through the water, and giving ſeveral colours to the ſame. For, firſt, " it is manifeſt, that deep waters have not the ſame colours as ſhallow; ſea water " in a baſon being without colour; but in its own proper place it is green. " Secondly, Coloured water in a conical glaſs hath various apparitions between " the baſe and vertex of the cone; that is, thick and thin bodies of water do not " ſhew alike. Thirdly, The ſea itſelf, when troubled and moved with ſand, is " not alike green, and all ſea water has ſand in it, for the white foam of the " ſea is ſmall ſand.

" 4. As a coloured varniſh ſpread over ſeveral-coloured grounds would ſhew " of ſeveral colours, ſo alſo the ſea water, which is ſuch a varniſh ſpread over the " bottom of the ſea, is of ſeveral colours, as the ſands and weeds there are; " and alſo their ſeveral diſtances from the ſurface will, and muſt, appear in ſe- " veral colours. 5. Being within the body of a cloud, or miſts, we ſee no dif- " ference of colours; but beholding clouds at a diſtance, we diſcern variety " enough of colour in them.

" 6. Hewers, who give directions to pilchard fiſhers, ſtanding on high places " over the ſea, do diſcern various colours in the ſea, which the pilchards make; " which colours are not diſcernable to the boats, which are amongſt the pilchards, " and at little diſtances from them.

" 7. I myſelf have taken notice, that a ſhoal ſea, looked upon from very high " land, doth appear of different colours: from all which I infer, that the ſea, ſeen " from ſuch hights, at which birds do uſually fly, doth appear in ſeveral reſpects " of diſtinct colours, of ſeveral ſhapes and dimenſions; all which put together,

" are

" are as good marks as can be desired. Now it is likely, that in all weathers the " colours are not wholly (though proportionably) alike, but in all times the shapes " and dimensions appear the same, or at least in the same situation and regards " one towards another, which is enough. For, if my direction be from a triangle " in the east, to a square in the west, lying within ken asunder, it is no matter, " whether their colours do now and then differ, or whether the corners of the " triangle and the square do shew now a little sharper, and at another time some- " what blunter. It is sufficient, that I see a triangle, suppose half as big as the " square, lying east and west from each other, and at about (suppose) three miles " distance; for the distance and position will not alter, and the difference in figure " and magnitude not very much: and, lastly, even the colour itself will change " according to such rules as may be known. Wherefore I conclude, that birds " crossing the sea have sufficient fixed marks for their direction.

" The fourth Miscellany is of the Mediterranean Sea.

" I remember, that long since I heard it agitated in this Society as an illustri- " ous problem to give the reason, why the Euxine and ocean both running into " the Mediterranean, as also many rivers, why the said sea doth not run over, " and by what ways it doth empty itself of what it doth visibly receive. Before " I advance further hereupon, I am to acquaint you, that one Mr. Sheres, who " hath long served his majesty at Tangier, hath an elegant piece ready for the " press concerning this subject, and that I had (though mediately) from him this " fuller account of the phænomenas following.

" 1. That the ocean runs into the Mediterranean at the Straits mouth about " nine months in the year, viz. from February to November.

" 2. That the water of the Mediterranean runs backward into the ocean for one " month in the year, viz. December, or about the winter solstice: that in No- " vember and January it ebbs and flows at the Strait's mouth about six foot.

" 3. That about the summer solstice, the current inward is so strong, as that a " boat of ten oars can but well stem it.

" 4. That the Levant wind blows there most part of the summer, and " that when that wind blows a storm outwards, there is a torrent inward of coun- " termoving water.

" 5. That there are but few and very small fresh rivers between the Nile and " the Strait's mouth, nor any considerable one between the Strait's mouth and " Cape Verd.

" 6. That the shore about the Mediterranean is bold and high land.

" 7. That the Mediterranean is in the middle of a vast continent, excepting " on the west side where the ocean enters it.

" 8. Spouts

"8. Spouts are more frequent here than in any other seas. From these eight "phænomena he concludes, without subterraneous communication with the Caspian Lake, and without fancying that the water, which comes in at the top, goes "out again at the bottom, he concludes, (I say) and I concur with him, 1. That "the Mediterranean is exhaled by the power of the summer sun exhaling its waters into vapours.

"2. That those vapours are the Levant wind rushing outwards, as through the "rostrum of a limbeck placed east and west.

"3. That these exhalations fall down and condense without and beyond the "mountains, which as lips encompass this sea; as appears by the paucity of "rivers falling into it, and consequently this sea, raised in vapours, is carried "into the ocean, where being condensed, it swells the said ocean, and from thence "is sent back into its own sinus, with a strong current, because the passage is but "narrow. Moreover, the exhalations aforementioned condensing beyond the "said lips, do furnish water to many other rivers, which fall into the ocean, and "thence back into the Mediterranean.

"4. When no vapours are raised or sent out, as in December, the Mediterranean sets outwards; but when it doth neither set in or out, then the tides "play their parts as elsewhere. Upon this occasion I put you in mind, that "you were told by Mr. Henshaw, that in the narrow of the Baltic, near Cronenburg and Copenhagen, the wind and seas, going the same way, do not "violently oppose each other, as in the Mediterranean, where, as was said, a "storm of wind outwards makes a torrent of water inwards.

"The fifth Miscellany is, of the getting or losing of the sea, and of bold "shores.

"Where some winds are stronger than others, and blow more frequently, there "the shores must change; as at Dublin, the westerly winds being far more frequent and strong, the water leaves the coast and impairs the harbour: and this "predominancy and south-westerly winds in the channel between England and "France may be a sufficient cause, why the shores are bolder, and ports more "frequent, on the English than on the French coast.

"The sixth Miscellany relates to the saltness of the sea.

"The water of the sea is not salt, because the sun hath exhaled the fresh water "from it; for if thirty-nine parts of forty of fresh water be evaporated, the "remainder will not be salt as sea-water is: but supposing it were, then it must "follow, that there is somewhere or other forty times as much fresh water as "there is of salt-water in the sea; and this thirty-nine parts of forty of fresh-water "must be somewhere between the sea and the sun. Now, if the sea in the deepest,

" est place be three miles perpendicularly deep, we may suppose the sea, one " place with another, to be half a mile deep. Wherefore there must be a body of " fresh water about twenty miles thick covering the whole globe of the earth: " and if this water be in vapour, the sphere of vapours made of ten miles thick " of water must be some thousand miles thick; whereas there are no clouds ten " miles high. Wherefore this opinion is very absurd; for in no country of the " whole world does the fresh-water, which is visible, seem to be $\frac{1}{10}$ of the salt or " sea-water in and about the same. It is objected, that the sea is fresh below " the surface: but we deny the fact, as not confirmed by experiment, and against " reason; for salt-water being $\frac{1}{45}$ part heavier than fresh, will not swim upon " it, but the contrary: nor doth the crystalizing of salt in salt-pans in the top " of them mend the matter; for the induration of brine into crystals is where " the greatest heat is, viz. in the top of the pans, according to the common " experiment, that the bottom of a boiling iron or brass-pot, taken off the fire, " may be safely touched with the flat of ones hand, whereas the top water will " scald vehemently.

" Wherefore, supposing sea-waters were created fresh or salt, it seems a more " natural question (because there is more salt than fresh-water) to suppose all " were salt, and then to enquire, how rivers and other shallow inland waters come " to be fresh, rather than supposing all waters to have been originally fresh, to " seek why the sea is salt; for that a little fresh water may be made out of much " salt-water is most obvious by rains and the common distillations.

" But if one would know, why the sea is salt, we must have recourse to some greater " body than the sea; that is, to the whole bulk of the earth, over part whereof the " deepest sea is but a varnish, the earth being above seven thousand miles thick; " and the sea no where three miles deep. Upon this method of enquiring, we " say, that every part of the earth contains salt of one kind or other; that every " plant yieldeth a fixt salt, not unlike common sea-salt. We know there be " salt-springs and brine-pits rising out of the earth, and that there be rocks of salt " in many places. Wherefore it is not to be wondered, if the waters, as well as " the earth, have their share of salt also; for as in sea-water about the forty or " fiftieth part is salt, so in many earths it is the same, and consequently a thing " not to be wondered at. That some seas may be salter than others, may be " from the different quantities of subterraneous salt, which it meets with. That " fresh-water may be found in the bottom of salt-sea is more difficult to conceive, " since the salter is heavier: but this is not difficult to him that considers, that " fresh waters may be shot by a fit spring through salt-water without much mix- " ture; nay, that fire may be shot through water without quenching; for a gre- " nado falling into a mill-pond has been seen to drive away all the water from " about it, and to burn for a little while as on dry ground. So a spring of fresh- " water, fed from a mountain much above the sea, may, like garden-fountains " supplied from cisterns on high turrets, boil up through a small body of salt- " water. Parallel hereunto is the eruption of hot springs through cold waters, " which in many places have happened.

" The

" The feventh Mifcellany is of tides and currents.

" That the furfaces of agitated waters are not true levels is plain from experiments of all forts and fizes; for water moved in a trough is not fo: and the waters in the canal of St. James's Park, when the wind blows hard right up and down the fame, are vifibly feen to accumulate on the leeward end; and when winds blow long into fome capacious bays, then upon the ceafing of fuch winds, the water returning back towards its level makes a current, fuch as are often met with in navigations. Hence it comes to pafs, that the tides rife higher at fome places than at others; as, for example, in fome of the finufes in the weft of Ireland, which have a near communication with the vaft Weftern Ocean, there the tides are neither rapid, nor is the difference between the hight of the water at full fea and low water much: but in the Severne, where the ocean comes in, as into the wide end of a horn, ftill ftraitning itfelf, there the tide runs ftronger and ftronger, and alfo the further it goes up with the land, and the difference between high and low water at the bottom of fuch indraughts, as at Chepftow bridge, is above thrice what is in thofe parts of Ireland above-mentioned.

" The eighth Mifcellany is of the various courfe or running of tides.

" The laft thing I fhall trouble you with, is the reafon of the feeming whimfical and diforderly motion of the waters at feveral ftates of the tides. That water fhould run or flow from north to fouth till half flood, and then quite contrary, as may be feen about Anglefey, where the fea comes in at one end of the ifland, but comes not in at the other end till it hath accumulated water enough to pafs fome mighty bank, but then comes in with fuch a violence, as doth repel the firft more gentle motion of fewer and weaker waters. And what happens in diurnal tides, happens by parity of reafon in neap and fpring-tides: and this *lufus naturæ* is very great, and feems ftupendous in fome of the weftern iflands of Scotland, as I have heard that memorable fellow and friend of this Society, Sir ROBERT MORAY, defcribe them.

" But there is nothing in this irregularity, which may not be mechanically explained, and even reprefented to the eye upon fuch figurations of the bottom and fides of the fea, as were not long fince fent to this Society by the favour of prince RUPERT."

Mr. OLDENBURG read a letter to himfelf from Mr. HEVELIUS, dated at Dantzick, 25th March, 1675 [k], concerning his obfervations of the laft eclipfe of the moon, 11th January, 167$\frac{4}{5}$, N. S.

April 15. A defcription of Monf. LEIBNITZ's watch was read, wherein was explained the principle of the exactnefs of the pocket-watches of his invention [l].

[k] Letter-book, vol. vii. p. 133. It is printed in the Philofoph. Tranfact. vol. x. n° 113. p. 289. for April, 1675.

[l] Letter-book, vol. vii. p. 213. See Philofoph. Tranfact. vol. x. n° 113. p. 285. & Journal Des Sçavans de 25 Mars, 1675.

His letter to Mr. OLDENBURG concerning it, dated at Paris, 30th March 1675, contained likewise his remarks on several algebraical subjects relating to Mr. JAMES GREGORY, Mr. NEWTON, and Mr. COLLINS, together with the different sentiments of the Parisian astronomers concerning common and telescopical sights.

Mr. OLDENBURG read a letter to himself from Dr. BEAL, dated 31st March, 1675, concerning some advantages, that may be made by ingrafting in roots, as it had begun to be tried by Mr. LEWIS, for the speedy raising of an orchard and a grove, or a nursery of mulberry-trees, and for the alteration or mixture of vegetables: and how to make one tree or stock bear many, much differing, kinds of fruit, as apples, pears, nuts, grapes, plums, and cherries.

Mr. OLDENBURG read a paper in Latin, of Dr. VOSSIUS, containing some considerations upon Mr. HOOKE's animadversions on his former papers, concerning the spots of the moon and the Archimedean burning-glasses.

Mr. HOOKE remarked, that a good observer would see, that the tops and sides of the circular ridges, that surround the spots in the moon, are enlightened *gradatim*, and not alike, and all together; which latter must be the case, if Dr. VOSSIUS's hypothesis were true.

He appealed to the members present, whether parabolical speculums were not better for burning than such flat ones, as Dr. VOSSIUS insisted upon.

Dr. VOSSIUS's paper was ordered to be registered [m].

April 22. Dr. WALLIS's printed discourse concerning gravity, read before the Society 12th November, 1674, was presented to it.

Mr. BOYLE's *Discourse concerning the mechanical production of Tastes* was read; wherein he proved by twelve experiments, that tastes may depend upon the size, figure, and motion of the saporous particles, and altered or destroyed according as those parts are by various conditions diversified.

These experiments were as follow:

1. To divide a body almost insipid into two bodies of very strong and very different tastes.

2. Of two bodies, the one highly acid and corrosive, and the other alkalizate and fiery, to produce a body almost insipid.

3. Of two bodies, the one extremely bitter, the other extremely salt, to make an insipid mixture.

[m] It does not appear in the Register.

4. Of two bodies, the one extremely ſweet, and the other ſalter than the ſtrongeſt brine, to make an inſipid mixture.

5. Of an inſipid body, and a ſour one, to make a ſubſtance more bitter than gall or aloes.

6. Of an inſipid body, and highly corroſive one, to make a ſubſtance as ſweet as ſugar.

7. Of obtaining, without addition from the ſweeteſt bodies, liquors corroſive enough to diſſolve metals.

8. To divide a body bitter in the higheſt degree into two ſubſtances, the one extremely ſour, and the other perfectly inſipid.

9. To produce variety of taſtes in one inſipid body, by aſſociating it with divers menſtruums.

10. To produce variety of taſtes with one menſtruum by aſſociating it with inſipid bodies.

11. Of two liquors, the one highly corroſive, and the other very pungent, and not pleaſant, to compoſe a body of a pleaſant and aromatic taſte.

12. To imitate by art, and ſometimes even in minerals, the peculiar taſtes of natural bodies, and even vegetables.

To this was added an excurſion concerning ſome changes made of taſtes by maturation.

It was ordered, that the hearty thanks of the Society be returned to the noble author of theſe experiments; and that he be deſired to publiſh them [n].

Mr. HOOKE was put in mind to make trials with the quadrant, for which the Society had been at near fifteen pounds expence.

April 29. Sir PHILIP PERCIVAL, Bart. was admitted a fellow.

Mr. EVELYN read part of his *Philoſophical Diſcourſe of Earth, relating to the Culture and Improvement of it for Vegetation and Propagation of Plants*, deſcribing firſt, what he meant by earth; then enumerating the ſeveral ſorts and kinds of earth; and, laſtly, ſhewing how we may improve it to the uſes of the huſbandman, the forreſter, and the gardener.

He gave, amongſt other things, an account of the microſcopical obſervations, which he had made of ſeveral ſorts both of earth and dungs, to ſee, if by thus examining the ſeveral earths and ſoils, he might detect what rudiments of the principles of vegetation there were lurking in them abſtractedly taken.

[n] They are printed at London, 1676, in 8vo. in his book intitled, *Experiments, Notes, &c. about the Mechanical Origin or Production of divers particular Qualities, &c.*

Having

Having proceeded to that part, where he treats of ſtercoration, or manuring the ground by compoſt; and that ſubject being of ſuch extent, as to require more time than was then remaining, he deſired to defer it till another time, viz. the 13th of May.

April 30. The Council was ſummoned, but did not meet.

May 6. At a meeting of the Society

Mr. Oldenburg preſented ſeveral letters and papers lately come to his hands from his correſpondents.

Firſt, a letter from Mr. Gregory, dated at Edinburgh 25th April, 1675 [o], giving an account of the inclinations and abilities of Sir George Mackenzie of Tarbat for a philoſophical correſpondence; who had alſo ſent ſeveral letters, containing obſervations of remarkable particulars in the Highlands of Scotland [p], and promiſing more.

Secondly, a paper written by an anonymous author, containing a conjecture about the bladders of air, that are found in fiſhes, and the manner and organ, whereby fiſhes move to and fro in the water, from one depth to another [q].

Thirdly, a deſcription of a newly invented water-engine, which by the only weight of the falling water (without the force of man or beaſt, and without wind or wheels) ſhall raiſe as much water as you will, and to what hight ſhall be deſired; and requiring no more charges than the workmanſhip amounts to.

May 13. Mr. Evelyn continued to read his *Diſcourſe of Earth*, and explained what advancement of fertility might be expected from ſtercoration and manuring the ground by compoſts. He enumerated, what compoſts may be had from animals, vegetables, &c. and intimated, that what ſeems moſt apparently to cauſe fertility is ſalt; yet without determining, that it is only ſalt or ſpirituous nitre, which produces that effect: and by inquiring into the ſeveral kinds of compoſts and materials of improvement, he hinted the moſt genuine and true medicament of every ſoil for arable, paſture, or garden. He inſerted a deſcription of the beſt hot-bed, that he knew of: and after he had ſhewed, how to prepare, ripen, and apply the ſeveral compoſts, which are called the dry mixture, he deſcribed the liquid; and gave ſeveral conſiderable proceſſes of that kind, uſeful to render the earth fertile, and to multiply grain.

He was thanked by the Society for this uſeful diſcourſe, and deſired to publiſh it after it had been regiſtered [r].

May 20. Dr. Simpson was propoſed candidate by Sir William Petty.

[o] Letter book, vol. vii. p. 141.

[p] They are printed in the Philoſoph. Tranſact. vol. x. n° 114. p. 307.

[q] This paper is printed ibid. p. 310.

[r] Regiſter, vol. v. p. 5. It was printed at London in 1676, in 8vo.

 Then

There was read a discourse concerning the several motions of the seas and winds; which was a translation of part of Dr. VOSSIUS's Latin treatise, *De Motu Marium & Ventorum*, brought in by Mr. COLWALL.

The author was of opinion, that the sun between the tropics beating perpendicularly upon the seas, raises thereby the waters, and so causes a descent and motion from east to west; which motion, he said, produces the variety of winds, and likewise of tides, according to the variety of coasts, with which it meets.

Some of the members reflecting upon this hypothesis, were of opinion, that though a hot body held over water would raise vapours from it; yet it would not raise the water itself.

Mr. HOOKE produced his telescope, which being directed to the sun, rendered, by divers reflections, the beams of the sun so weak, that one might look upon the sun with as little inconvenience to the eye, as upon the moon.

May 27. Mr. OLDENBURG produced several relations, which he had received from his correspondents.

The first was from Mr. LOCKE, dated 20th May, 1675 [*], giving an account of some fishes, that are poisonous, in New Providence, one of the Bahama islands; which account had been sent to Mr. LOCKE from a friend in that island; viz. that the fish, that are there, are many of them poisonous, causing a great pain in the joints of those who eat them; yet do not kill any man, though they are fatal to cats and dogs: but with two or three days itching the pain in men wears off. It was added, that those of the same species, size, shape, colour, and taste, are some of them poisonous, others not the least hurtful; and those, that are, only to some persons, and not to others: and farther, that those persons, who have been once distempered by them, have, upon the first eating even of wholesome fish, the poisonous ferment in their bodies revived thereby, and their pain increased.

The second paper was from captain RICHARD TAYLOR, commander of the ship Agnes and Grace, written 30th December, 1674, to Mr. BENJAMIN NEWLAND, merchant in London, concerning a sword-fish, that had struck his sword through a three inch plank of that ship, and thereby rendered it so leaky, that both the pumps could scarce keep her from sinking, &c.

The third was from Paris, 6th May, 1675, giving an account from Monf. LEMERY, how mercury effects salivation, viz. by uniting itself with the saline or acid ferment of the morbific matter, and so by being actuated with the heat of the bowels, passing to the head, and swelling it, and overspreading the inner part of the mouth with cancres, that make the patient feel a pain like that, which would be felt, if some corrosive sublimate should excoriate some part of the body. Monf. LEMERY added, that the salival glandules of the mouth being pricked by

[*] Letter-book, vol. vii. p. 234. It is printed in the Philosoph. Transact. vol. x. nº 114. p. 312.

this

this ſharpneſs are relaxed, and ſo come to ſalivate, which continues till the ſaliva has cleanſed all the piquant ſalts, that kept the veſſels open.

This hypotheſis was thought by ſome members unſatisfactory, becauſe the mercury will cauſe ſalivation in ſound bodies likewiſe. Upon which it was queried, whether to this mercurial ſalivation it be not always required, that the quickſilver be mixed with ſome ſaline particles or other?

Mr. HOOKE promiſed to bring in his helioſcope perfected; and likewiſe another experiment.

June 3. There was read out of the Regiſter a diſcourſe of Dr. JACKSON, a phyſician in Cheſhire, giving an account of the ſalt ſprings of that country.

Mr. HOOKE took occaſion from the mention made in that diſcourſe of an extraordinary hole, to relate, that he had been informed by a friend of his, living at Briſtol, that near that city there was a hole of an extraordinary depth, in which at a great diſtance from the ſurface of the earth there ran a river, which being ſounded was found of a vaſt depth. He ſaid, that he was promiſed a more particular account of the obſervables of that place.

Dr. DANIEL COXE made mention of a mountain in Braſil deſcribed by PURCHAS, which the people can go into at a hole in one ſide, and come out at another hole on the other ſide.

Mr. HOOKE related, that there was a place in Cheſhire belonging to the lord BRERETON, where men having dug to a great depth for water to make ſalt with, but having met with none, lighted at laſt upon a ſtiff clay ground, which when they had bored into about five or ſix feet, the ſalt water from underneath the ſaid bed of clay guſhed out with ſuch great violence, and in ſuch a great quantity, as to fill the well, which was ſome hundreds of feet deep, to the top.

This gave occaſion to ſpeak of the origin of ſprings and rivers; ſeveral of the members being of opinion, that they were cauſed by rain and ſnow.

Sir JAMES LONG promiſed to communicate to the Society the obſervations, which he had made of the natural curioſities in Wiltſhire, his own country, and particularly of the ſprings there, and the ſeveral ſorts of earths, eſpecially of a fine azure earth near Chippenham in Wiltſhire; as alſo of an extraordinary kind of periwinkle ſtones, ſhaped like ſcrews; and likewiſe the ſeveral improvements of land made there.

Sir WILLIAM PETTY remarked, that it would be worth inquiring, where and and in what grounds ſaintfoin and clover-graſs had ſucceeded beſt; and where it had failed moſt.

Sir JAMES LONG anſwered, that he knew one place near Chipping-Norton, called

called Haftings, which had made the greateft advantage by faintfoin of ay place he had heard of; and he had obferved, that the faid feed did not thrive in a good conditioned, but in a cold, ftony, clay ground: but that, on the contrary, clover required a good barley ground.

June 10. Mr. OLDENBURG communicated an account fent to him from Paris concerning the origin of rivers [t]; in which the author being of opinion, with many others, that rain and fnow were fufficient to caufe and to maintain them, had taken the pains for feveral years together, to obferve the quantities of rain and fnow, that had fallen, and reckoned them at a medium of about nineteeen inches and 2 $\frac{1}{3}$ lines; and thereupon compared the quantity of fuch rain and fnow with the quantity of water running away in rivers; having firft laid down a way of meafuring thefe two forts of water, not leaving unconfidered the velocity of the running of rivers and the extent of the land, on which the rain and fnow, ferving for the fupply of rivers, do fall. The refult of which eftimate of his was, that the rain and fnow waters are abundantly fufficient to make rivers run continually.

Some of the members commended the attempt of this author.

Mr. HOOKE remarked, that the fame had been performed and propofed to the Society many years before Sir CHRISTOPHER WREN, who, by the contrivance of a rain-bucket, had taken an account of the water, that fell for a long time together, and by his weather-clock had, among other particulars, not only taken in the meafuring the quantity of rain, that fell, but alfo the time, when it fell, and how much at each time: which gave occafion to mention the important ufes to be made of that inftrument, if put into practice; fince it was, by fome additions made thereunto by Mr. HOOKE, adapted to record the weight of the air; the drought and moiftures, the heat and cold, of the weather; the quarters and ftrength of the winds; the rain, fun-fhine, &c. and all this to be performed by one motion, driving all the parts of the inftrument; which was the more confiderable, for that itfelf records its own effects.

June 17. At a meeting of the COUNCIL were prefent

The lord vifcount BROUNCKER, prefident,

Sir JOHN LOWTHER,	Mr. COLWALL,
Sir JOHN BANKES,	Mr. HILL,
Sir ROBERT SOUTHWELL,	Mr. OLDENBURG.

It was ordered, that a treatife intitled, *Francifci Willughbeii de Middleton Armigeri; quondam e Societate Regia, Ornithologia*, be printed by JOHN MARTYN, printer to the Society: And,

That a difcourfe made before the Society the 29th of April and 13th of May

[t] See Philof. Tranfact. vol. x. n° 119. p. 447. for November, 1675.

laft,

last, by JOHN EVELYN, Esq; concerning the improvement of earth for vegetation, be printed likewise by the said JOHN MARTYN: And,

That a treatise, intitled, *Marcelli Malpighii Philosophii & Medici, e Societate Regia, Anatome Plantarum: cui subjungitur Appendix repetitas ab eodem Auctore de Formatione Pulli in Ovo Observationes continens*, be printed by the said JOHN MARTYN.

At a meeting of the SOCIETY on the same day,

Dr. JOHN FRANCIS PREISS, physician of the prince of Newburg, was proposed candidate by the earl marshal of England.

Dr. GREW brought in and read his discourse concerning the trunks of plants, which he divided into seven parts;

1. Of the motion of the sap in such trunks.
2. Of the motion and course of the air in them.
3. Of the generation and structure of the parts of a trunk.
4. Of the generation of liquors contained in them.
5. Of the several figurations of trunks.
6. Of the motion of trunks upwards, downwards, sideways.
7. Of the several qualities, whereby trunks are fitted to divers mechanical uses.

Dr. GREW had the thanks of the Society given him for this discourse, and was desired to give it to be registered [u], and to publish it [x].

Sir WILLIAM PETTY took occasion from this discourse to propose it to consideration, what might be deduced from the discourse read for explaining the cause of the warping of wood; concerning which Mr. HOOKE said, that there was a fermentation in the liquors of wood, which required a considerable time to do its work, which was by making the liquors work upon one another, to separate the moisture, without which there was no fermentation; and which being driven out, the wood was then seasoned, and so warped not; so that by destroying the fermentative principle, the wood was preserved, and made to retain its figure, and so kept from warping.

The ascension of sap in trees being also spoken of, there were mentioned several opinions concerning it. Dr. GREW alledged his opinion, delivered in the discourse. Mr. HENSHAW said, that he thought the sun by force of its heat

[u] It does not appear in the Register.

[x] It is printed at London, 1676, in 8vo. under the title of *The Comparative Anatomy of the Trunks of Plants*, &c.

thrust up the moisture of the ground into the roots of vegetables; and that being got up a little way, the night and cold coming on made it stop, till the sun's heat of the next day returning drove up more moisture; which being crouded in must needs force up the moisture, that there was there before; and so on from day to day, till it came up to the top, and all the parts of the plant.

Mr. Hooke added, that it was worth a more particular inquiry, whether there were not valves, or something analogous to them, in vegetables.

Dr. Grew said, that he had hitherto observed no such thing as valves in the sap-vessels of plants.

Mr. Oldenburg mentioned, that Signor Malpighi had explained this phænomenon of the rising of sap after the manner, that Mr. Henshaw had discoursed of it; and that the same author, in his discourse of the anatomy of vegetables, dedicated to the Society, had taken notice of something like valves in plants.

June 24. At a meeting of the Council were present

The lord viscount Brouncker, president,

The lord bishop of Salisbury,	Mr. Hoskyns,
Sir John Bankes,	Mr. Oldenburg.
Mr. Hill,	

Mr. Willughby's *Ornithologia*, Mr. Evelyn's late discourse on agriculture, and signor Malpighi's *Anatome plantarum*, were licensed.

The council considering of the persons, who deserved to be expelled, thought fit to begin with the following:

Dr. Lower,	Mr. Waller,
Dr. Downes,	Mr. Slingesby.
Sir Edward Bysshe,	

Sir John Bankes reported, that the committee of the East India company had given order to empty the west gallery in Gresham-College, and to deliver it again to the Mercers company, from whom they had received it.

At a meeting of the Society on the same day,

Mr. Hooke produced again his helioscope, which had three reflections; the first reflecting the fifth, the second the twenty-fifth, and the third the hundred and twenty-fifth part of the direct light of the sun to the eye.

It being asked, whether by it he had observed any spots in the sun, he answered, that at present there were none, that he could see.

Mr.

Mr. Oldenburg brought in ſeveral earths ſent him by Dr. Plot from Oxford, which the ſaid doctor had met with in his ſurvey of that ſhire, but knew not their names; which therefore he deſired might be ſent him from hence, he being then about digeſting and printing his obſervations made of Oxfordſhire.

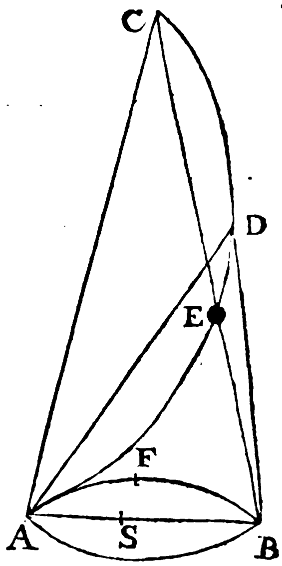
The particulars being viewed, it was thought fit, that Dr. Plot ſhould be deſired to ſend greater quantities of them, and to add the ſeveral places, where they were found, and the beds, wherein they lay; whereupon they might be better examined, and their names returned with more certainty.

Mr. Oldenburg communicated a letter to himſelf from Mr. Gregory, dated at Edinburg, 8th June, 1675 [y], deſcribing a way of his to prove the motion of the earth, different from that of Mr. Hooke publiſhed ſome time before; as alſo aſſigning the limits of a biquadratic æquation by the roots of a quadratic æquation.

Mr. Gregory's letter is as follows:

" Sir,

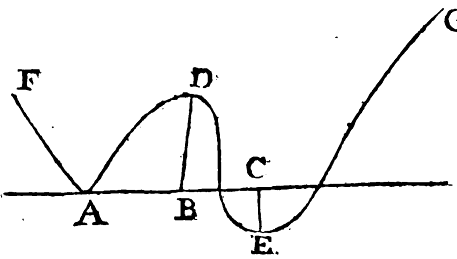
" By M. Collins his favour I have ſeen M. Hooke's " excellent treatiſe for proving the motion of the earth; " and have had ſome thoughts thereon, which perchance, " if not too obvious, and already known to you, may be " of ſome conſequence. Let C D be two fixed ſtars; " S the ſun; C D B A a plain going through the three " points C D S, and cutting the orbs of the earth in A " and B; let a circle paſs through the points A C D, " cutting C B in E: the ſine of the angle C A D is to " the ſine of the angle C B D, as B D to D E; which " proportion may be pretty ſenſible, if the ſtar D be much " nearer than C; yea, ſometimes perchance ſo ſenſible, " that D may from B ſeem on the one ſide of C, and " from A on the other. The points A B in the orbs of " the earth may be with eaſe found out more preciſely " than is required for this buſineſs. My thoughts briefly " are theſe; if from A and B the angles C A D, C B D, " be obſerved and found unequal, from thence two things " may be inferred, hitherto queſtioned, viz. the motion " of the earth, and the unequal diſtance of the fixed ſtars. Secondly, theſe " angles (as to the inequality, if ſuch thing be) may be obſerved eaſily, becauſe " any two ſtars in the firmament, if they fall within one view of the teleſcope, " may be choſen for this effect; one of which may be a large ſtar of the firſt " magnitude, and conſequently by all probability near to us; and the other of " the ſixth, yea, perchance of the ſixtieth magnitude, and far from us: and, " which is moſt of all, this, without any conſiderable preparation, may be eaſily " and exactly obſerved by any ſort of micrometer; or (if D be ſeen on both ſides



[y] Letter-book, vol. vii. p. 241.

" of C, which may sometimes fall out) with a simple telescope. If it be ob-
" served, that from this only can be gathered, that the fixed stars have parallax,
" and not how much it is in this or that star, albeit the main business be to prove
" they have parallax: yet from a third observation, as suppose at F, may be
" gathered geometrically the parallax of both C and D, if that be esteemed *operæ-*
" *pretium.*

" I lately received a letter from M. COLLINS; he desires therein the limits of
" a biquadratic æquation by the rules of a quadratic æquation, which is as fol-
" lows: let the æquation be (seeing always the second term can be taken away)
" $x4 - p2x2 + q3x - r4 = o$; and let $x = \frac{t^2}{3}$; the former æquation becomes
" $z4 - \frac{q3t^2z^3}{r4} + \frac{p2t4}{r4}z2 - \frac{x8}{r4} = o$: the limits of this biquadratic æquation are
" so determined; (and to this former all biquadratic æquations can be reduced
" after this manner.) Let the curve for this æquation be F A D E G, whose
" maxima and minima are A D E; for always in this case one of the limits falls
" in A, the beginning of the reckoning.
" Let ordinates from the limits be D B C E
" the points B C are so determined: multi-
" ply the terms of the last æquation in their
" exponents, and it becomes $z2 - \frac{3q \times 2}{4r4}$
" $z + \frac{p2+4}{2r4} = o$; here z is found, which
" in this present æquation is A B or A C,



" viz. $z = \frac{\pm\sqrt{39q6t4 - 32p2t4r4} + 3q3t2}{8\sqrt{4}}$; all this time t is undetermined;
" for it may be put ad libitum; which shews that this may be done infinite seve-
" ral ways."

Mr. HOOKE said, that he had made mention of this way likewise in his printed book; which he was desired to shew.

Mr. OLDENBURG produced a printed scheme sent him from Paris concerning a pear, that had brought forth another little pear at and through the head of it, and at the top of it some leaves; which fruit having been opened at Paris longways, and cut through in the middle, there was no core nor kernel found in it, but it had firm pulp throughout; and the ligneous fibres, which the stalk uses to emit in the place, where it sticks in the pulp, continued to pass on through the whole middle of the pear, and so produced the small branch and leaves above-mentioned. Besides which it had been observed, that the pulp of the mother-pear was separate from the pulp of the other infant-pear, which was not quite come out, but still stuck fast in the head of the mother-pear.

June 28. At a meeting of the COUNCIL were present

The

The lord bishop of Salisbury, vice-president, in the chair,

Sir JOHN LOWTHER, Mr. COLWALL,
Sir WILLIAM PETTY, Mr. HILL,
Mr. HENSHAW, Mr. OLDENBURG.
Dr. WHISTLER,

Inquiry being made, whether the west gallery in Gresham-College was emptied, it being found not to be so yet; Mr. HOOKE was ordered to call upon the officers of the East India company to remove their goods, according to the order of the committee of the said company.

It was ordered, that the amanuensis do from the council attend Mr. NELTHROPE, and demand the arrears of his quarterly payments due to the Society at Midsummer preceding, amounting to fourteen pounds nineteen shillings; acquainting him with the order, that whosoever of the Society shall refuse to pay their arrears due by their subscriptions at their admission into the Society, shall be proceeded against according to statute.

July 1. At a meeting of the Society,

There were read several letters,

1. From Mr. FLAMSTEAD to Sir JONAS MOORE in Latin [z], containing his observations on the eclipse of the Moon, 26th June, 1675.

2. From Mr. RAY to Mr. OLDENBURG, dated at Middleton, 26th June, 1675 [a], concerning the use of the swimming bladders in fishes, viz. to sustain or keep them up in any depth of water: since, as it had been experimented, if the swimming bladder of any fish be pricked or broken, such a fish sinks presently to the bottom, and can neither support nor raise itself in the water.

3. From Mr. LISTER to Mr. OLDENBURG, dated at York, 27th June, 1675 [b], containing some observations sent him by Dr. THOMAS TOWNE from Barbadoes about the temper of the air in that island, divers European plants growing there as well as in England; all springs being there near the sea; the blood of negros being as black as their skin, &c.

4. From Signor MALPIGHI to Mr. OLDENBURG, dated at Bologna, 17th June, 1675, acquainting the Society with his endeavours of observing and delineating the structure of the galls of trees, &c.

July 8. Mr. HOOKE shewed an experiment concerning the resistance of air to a ball moved with and without an expanded area; of which he was desired to bring in a particular account in writing.

[z] Letter book, vol. x. p. 252. It is printed in the Philosoph. Transact. vol. x. n° 116. p. 371.

[a] Letter-book, vol. vii. p. 252. It is printed in the Philosoph. Transact. n° 115. p. 349.

[b] Letter-book, vol. vii. p. 256. It is printed in the Philos. Transact. vol. x. n° 117. p. 399.

The Society was adjourned this day till the prefident fhould think fit to fummon them to meet again.

October 21. At a meeting of the COUNCIL were prefent,

The lord vifcount BROUNCKER, prefident,

Sir JOHN LOWTHER,
Sir JOHN BANKES,
Mr. COLWALL,
Mr. HILL,
Mr. OLDENBURG.

It was ordered, that the following perfons be fent to for their pofitive anfwer, whether they would fign the bond or not, viz.

Dr. AGLIONBY,
Sir CHARLES BERKLEY,
Dr. BRUCE,
Mr. CARKESSE,
Sir WINSTON CHURCHILL,
Col. COLEPEPPER.
Sir RICHARD CORBET,
Mr. CURTHOPE,
Sir FRANCIS FANE,
Mr. HAMMOND,
Mr. LAKE,
Dr. DU MOULIN,
Sir THOMAS NOTTE,
Mr. SOAME,
Mr. STANLEY,
Mr. WYNDE.
Mr. WOODFORD,
Mr. WOODROFFE,
Dr. WREN.

And it was thought fit, that thofe, who were deep in arrears, and gave no hope of being of ufe to the Society, fhould be all expelled.

It was ordered, that the Society fhould be fummoned to meet again on the 28th of October:

That MICHAEL WICKS do attend Sir JOHN BANKES the next day at the Eaft India Houfe to receive the order for clearing the weft gallery in Grefham-College: And,

That Dr. GREW's book, intitled, *The Comparative Anatomy of Trunks, together with an Account of the Vegetation of Trunks grounded thereupon, in two parts, the former read before the Royal Society, February* 25, 167$\frac{4}{5}$, *the latter June* 17, 1675, *the whole explicated by feveral figures in nineteen copper-plates, prefented to the Royal Society in the year* 1673, and 1674, be printed for WALTER KETTLEBY by the affignee of JOHN MARTYN, printer to the Royal Society.

October 28. The Society returned to their weekly meetings.

Dr. GREW read a lecture concerning the nervous liquor, its origin, nature, motion, and ufes in the body; as alfo the fymptoms and diftempers arifing from it, when difordered or vitiated.

He

He was desired to leave it to be registered [c], and to publish it.

Mr. OLDENBURG communicated two letters to himself: one was from JOHN CRUZADO, professor of the mathematics at Seville in Spain, dated there 20th August, 1675 [d]; in which was proposed a new place for the first meridian, which is a little island called *Abruxos* lying under the very equinoctial near Brasil; in which island there is said to be no inequality at all in the natural days. The writer of this letter likewise asserts a method of knowing the true place of the moon.

It was ordered, that he should be thanked for his communications [e], and acquainted, that the Society did not dislike the place assigned by him for the first meridian; but that they could not assent to his assertion concerning the equality of all natural days, nor to that which related to the method of knowing the true place of the moon.

The other letter was from Signor TRAVAGINO, dated at Venice, 26th June, 1675 [f], containing a description of a way used to fix quicksilver into silver; together with a piece of the metal thus fixed; which was produced before the Society, and there cut through to see how it looked in the middle, where it appeared as white as on the outside.

Mr. OLDENBURG related, that he had given some of it to Mr. BOYLE, to try it, who had assured him, that having tried it in a coppel, it had endured that trial as well as silver doth: but he having weighed it in water, it proved not so ponderous as silver, but wanted somewhat of the weight of tin. So that this seemed to be a new metal, having the whiteness, malleableness, and fixity of silver, but not the weight thereof.

It was desired, that a little of it might be given to the assay-masters of the mint for farther confirmation.

November 4. Mr. OLDENBURG produced a box, containing divers minerals sent from Oxford by Dr. ROBERT PLOT, who intended to compose a natural history of all England; of which particulars he desired to know the names and uses. The chief of them were, 1. Some earths resembling bolus's and *terra sigillata*. 2. Some stone, thought to contain *lapis calaminaris*. 3. Some slate, like mundick. 4. A substance like alabaster, which might, it was thought, be very fit to make good morter of. 5. Some fine powders, taken out of the veins of the earth. These and some others were found under ground in Oxfordshire.

Mr. HOOKE read a lecture, wherein he explained a mechanical contrivance to supply the pabulum of a lamp in the same degree it is consumed, or to keep the

[c] It does not appear in the Register.

[d] Letter-book, vol. vii. p. 272. It is printed in the Philosoph. Transact. vol. x. n° 118. p. 425.

[e] Mr. OLDENBURG's answer to CRUZADO, dated 15th September, 1675, is inserted in the Letter-book, vol. vii. p. 290. and printed in the Philosoph. Transact. vol. x. n° 118. p. 429.

[f] Letter book, vol. vii. p. 243.

surface

surface of any liquor, fit to feed the flame of a lamp, always at the same hight, till all be wasted.

Having both described and delivered one way of performing this, he promised to bring in divers other ways of effecting the same thing.

November 11. At a meeting of the COUNCIL were present,

The lord viscount BROUNCKER, president,
Dr. WHISTLER, Mr. HILL,
Mr. COLWALL, Mr. OLDENBURG.

A committee was appointed for auditing the treasurer's accounts, consisting of the president, Dr. WHISTLER, Mr. HILL, Mr. HOSKYNS, and Mr. OLDENBURG; three of whom were to be a quorum.

It was ordered, that the council be summoned to meet again on the Thursday following November 18, at twelve at noon.

At a meeting of the SOCIETY on the same day,

Dr. GREW gave an account of that Substance, which Mr. HOARE had put into Mr. OLDENBURG's hands for examination; which seemed to be petrified wood. He said, that he had viewed it with a microscope, and found it to have been a piece of birch-wood, now perfectly stone, having three or four rings in it, the *vestigia* of its former constitution.

Mr. OLDENBURG presented to the Society from the printer *a description of the islands and inhabitants of Feroe, &c. written in Danish by Lucas Jacobson Debes, M. A. and provost of the churches there: Englished by J. S. doctor of physic:* printed in 1675, in 12mo.

A letter in French to Mr. OLDENBURG by Monf. JOLY of Dijon, dated there, 28 September, 1675 [s], was read; in which he offered to communicate his meditations upon the nature of motion, if the Society did not think that subject altogether exhausted by Sir CHRISTOPHER WREN, Dr. WALLIS, and Monf. HUYGENS.

The Society declared, that though those persons had written very well upon that subject, yet the meditations and labours of others would still find place; and that therefore Monf. JOLY should be desired to prosecute and finish his thoughts upon so important a subject.

The earl marshal remarked, that he had in some land of his near Scotland at Graystock a river running from a mountain, reported to contain copper mines, out of which the cattle drinking got their teeth brazed over; as appeared from

[s] Letter-book, vol. vii. p. 157.

some of oxen and cows produced by his lordship, and left for the repository, which teeth had a kind of copper-colour superinduced upon them.

Some of the members desired, that some of the cattle, which had drunk a while of that water, might be opened, to see whether any thing remarkable appeared within their bodies.

Mr. HOOKE read another lecture about divers ways of keeping the pabulum of a lamp always at the same hight with the bottom of the flame thereof, till all the liquor be consumed. Of these methods he explained seven or eight more.

November 18. At a meeting of the COUNCIL were present

The lord viscount BROUNCKER, president,

Sir JOHN BANKES,	Mr. HOSKYNS,
Mr. HENSHAW,	Mr. HILL,
Mr. COLWALL,	Mr. OLDENBURG.
Dr. WHISTLER,	

It was ordered, that the following persons be left out of the list to be printed for the approaching election-day, viz.

Dr. BRUCE,	Dr. LOWER,
Mr. CARKESSE,	Sir THOMAS NOTTE,
Col. COLEPEPPER,	Mr. SLINGESBY,
Dr. DOWNS,	Sir PETER PETT.

The reason of omitting them was their not performing their obligation to the Society.

It was ordered, that the salary of the curator be not paid for the future by the treasurer but by special order of the council.

At a meeting of the SOCIETY on the same day,

A committee was chosen by ballot for auditing the treasurer's accounts, consisting of

Sir ROBERT REDDING,	Mr. HAAK.
Mr. BARRINGTON,	Mr. HOOKE.
Dr. CROUNE,	

Three of these to be a quorum, and to meet as soon as the committee of the council had made their report to the council concerning the state of the said accounts.

Mr. OLDENBURG read an account of some experiments made in the air-pump by

by Monf. PAPIN, directed by Monf. HUYGENS. They were feveral mixtures of divers liquors, as aqua fortis and fpirit of wine, aqua vitæ and fpirit of wine, common water and aqua vitæ, to fee what ebullitions they made *in vacuo*; and whether thefe ebullitions made new air; and the difference of the air formed by the mixture of aqua fortis and copper from that which was produced by the mixture of oil of tartar and oil of vitriol, of which two mixtures the former yielded an air always remaining, the latter not fo.

Befides thefe, there was an account of an experiment of a mixture of aqua fortis and aqua vitæ with bits of iron in it; fome of which was put *in vacuo*, fome not, together with the different effects of both. Likewife experiments with oil of olives with vinegar and with fpirit of wine; alfo with water and lime, and with plaifter of Paris flaked *in vacuo*; together with the confiderably different effects of them *in vacuo*, and in the open air.

Mr. OLDENBURG was defired to take care of entering thefe experiments in the Regifter [h], and, if he had any more of that nature, to impart them.

It was ordered, that the exhaufting engine fhould be put in order, for making more experiments in it; which was chiefly urged by Dr. CROUNE, who faid, that he intended to make fome trials therein.

Mr. OLDENBURG communicated Mr. NEWTON's anfwer, dated at Cambridge, 13th November, 1673 [i], to Mr. LINUS's letter to Mr. OLDENBURG from Liege, 25th February, 167$\frac{4}{5}$, N. S. [k], concerning an experiment relating to Mr. NEWTON's new theory of light and colours; which imports, that the experiment contefted was made in a clear day; and that the prifm therein employed was placed clofe to the hole; and that the coloured image was not parallel to the axis of the prifm, but tranfverfe to it: which three particulars being contradicted by Mr. LINUS, Mr. NEWTON, in this letter, directs his antagonift again very punctually, in what manner to try the experiment, to fatisfy himfelf about his veracity in relating the fame.

Mr. NEWTON offering, in the fame letter, to fend to the Society a difcourfe of his about colours, when it fhould be thought convenient, Mr. OLDENBURG was ordered to thank him for that offer, and to defire him to fend the faid difcourfe as foon as he pleafed.

November 25. At a meeting of the COUNCIL were prefent

The lord vifcount BROUNCKER, prefident,

The earl of Aylefbury,	Sir JOHN LOWTHER,
The lord bifhop of Salifbury,	Sir ROBERT SOUTHWELL,

[h] They do not appear there, but are printed in the Philofoph. Tranf. vol. x. n° 119. p. 443. for November, 1675.

[i] Letter-book, vol. vii. p. 275. It is printed in the Philofoph. Tranfact. vol. x. n° 121. p. 500.

[k] Letter-book, vol. vii. p. 202. It is printed in the Philofoph. Tranfact. n° 121. p. 499.

Mr.

Mr. HENSHAW,
Mr. COLWALL,
Dr. WHISTLER,
Mr. HILL,
Mr. HOSKYNS,
Mr. OLDENBURG.

It was ordered, that the prefident or his deputy be defired to intimate to the Society on their approaching anniverfary election-day, that they could not but take notice of fome perfons left out of the lift: that this was done, becaufe they were found not to have performed their obligation to the Society: and that therefore the council intended to proceed againft them according to ftatute: and that the names of thofe perfons fhould be then publicly read, viz.

Dr. BRUCE,
Mr. CARKESSE,
Col. COLEPEPPER,
Dr. DOWNES,
Dr. LOWER,
Sir THO. NOTTE,
Mr. SLINGESBY,
Sir PETER PETT.

It was ordered alfo, that the prefident be defired to give directions to the treafurer, for demanding and receiving the rent of the twenty-four pounds due for the four hundred pounds legacy of the late Dr. WILKINS, bifhop of Chefter.

At a meeting of the SOCIETY on the fame day,

Dr. WALTER NEEDHAM made an experiment upon a dog, to fhew, that the lymphatics of the liver inofculate in the extremity of their trunks with the *pori bilarii*, which, he thought, could not be faid of any two diftinct forts of veffels, that carry diftinct forts of liquors in them, throughout the whole body. The experiment was, that the injections of milk and water made into the *pori bilarii* filled not only the *vena cava*, but alfo the lympheducts, without mixing it with the blood.

He remarked, that he would have made another experiment upon the fame dog, if he had been duly fed, which would have fhewn, that the chyle poffeffes not only all the neceffaries, but likewife all the other lympheducts and glands upon the iliac veffels, and under the cava; and not only fo, but that the who'e mafs of fuet, that is upon the loins, is likewife filled with it; in which place, he added, it feemed to be all extravafated, and gathered up again afterwards into the veffels, to be conveyed to the receptaculum. Of which extravafation he mentioned this obfervable effect, that the fat of the loins differs in feveral animals, according to the difference of the milk and chyle. Where they are full of butter, and otherwife grofs, this fat is thick and folid, as in the fuet of beeves, fheep, and goats: but where they are thin, the fat is foft and greafy, as may be feen in the leaf of a fwine, in dogs, horfes, men, &c.

This experiment being made, Dr. NEEDHAM read a difcourfe of his *on the ferum of blood*, which he was defired to leave with the fecretary, in order to be regiftered [1]; which he confented to, after he had revifed it. It was as follows:

[1] Regifter, vol. v. p. 125.

" When I designed the analysis of the liquors of the body, the first, that oc-
" curred to my consideration, was the chyle, it being the first product of the nou-
" rishment, and consequently the first in order of concoction of all animal liquors.
" But when I came to inquire into that, I found it impossible to discover the na-
" ture of it, till I had before searched out the causes of its production; the two
" efficients of which seemed to me to be heat and a ferment; both which owing
" their origin to the mass of blood, it proved necessary to examine the blood itself.

" What blood is, and what are the constituent parts of it, we find many ways
" delivered in authors, with great variety of opinions, too many and too long to
" be here recited. I, that designed the satisfaction of my senses first, and my
" reason afterward, did resolve to follow the most simple and natural way of ob-
" servation. And first considered the blood as it was let out into a porringer,
" where all the parts I could observe were two; viz. the grumous cake and the
" limpid serum. This I do mean of blood, that is pure, without either degene-
" ration of its parts from morbific causes, or recent mixture with chyle; so that
" the chyle itself unchanged appeareth in the porringer. Those two cases being re-
" moved, I say, that the visible parts, which the blood doth naturally separate itself
" into, are the two before-mentioned, viz. grumus and serum. Neither are these
" so very heterogeneous from each other, as upon first sight they may appear;
" but upon distillation are found to consist of the same parts, differing only in the
" variety of proportion.

" Indeed if we look into the first originals of blood, we shall find it in its in-
" fancy to be pellucid, nor to have any thing red in it; that red colour being
" the effect of a progress of digestion, by the addition of actual heat, either that
" of incubation in oviparous, or of the womb in viviparous animals. For the
" egg itself is limpid, especially the cicatricula, and that so limpid, that it elud-
" eth the best endeavours of the microscope, which might otherwise discover
" much more of the lineaments of the fœtus in it, than yet the diligence of the
" great wits of this age can attain to. But when in process of time it doth
" grow red, and thick, and visibly move in a completely organized body, then
" it giveth us a fuller view of itself, and better opportunity of satisfying our under-
" standings. We then find the difference I have already mentioned, that appear-
" eth upon the effusion of blood, and its coagulation in a porringer; and if we
" consider it in its motions in the body, we find things much more observable.

" That I may begin with the first, we find two seemingly unlike parts of it,
" viz the grumus and serum; yet when we come to analise them by fire, we find
" them consist of the same parts, viz. phlegm, spirit, if I may so call it, volatile
" salt, oil, fixed salt, and earth.

" These, I say, are all to be found, but with this difference of proportion:
" in the example I chose to work upon, which was bullocks blood, lib. iiij. of the
" *serum* of bullocks blood, drawn off in MB, yielded of phlegm lib. ij. of a gross
" extract in the bottom lib. ij. This crassamantum or gross extract in the bottom
" yielded upon distillation in sand, spirit lib. j. ℥ix oil ʒiij. volatile salt ʒij. ℈j.
gr.

" gr. vj. caput mortuum ℥iij. ʒij. This caput mortuum did yield of fixed ſalt " by calcination ʒij. gr. v. Of the *grumus* of the ſame bullock we took lib. 6. " which in MB gave us of phlegm ℥xiv. extract lib. v ℥ij. This lib. v. ℥ij. of " extract drawn off in ſand, yielded of ſpirit lib. 4. oil ℥j. ʒj. volatile ſalt ℥j, ʒj. " the caput mortuum came to ℥x. This—  upon calcination yielded of fixed " ſalt ʒj. ℈ij. gr. iv.

" Here we ſee a great difference of proportion, the *ſerum* being more than " half phlegm, the grumus leſs than a ſixth part; the ſpirit of the ſerum about a " fifth part, of the grumus more than two thirds of the whole.

" The oil of the ſerum but little, viz. ʒiij. in lib. iiij. nor that of the grumus " much greater in proportion, viz. ʒix. in lib. vj. The volatile ſalt of the gru- " mus triple in proportion to that of the ſerum; the fixed ſalt of it much leſs, " but that but in ſmall quantity in both places. However, that there is ſuch a " thing as fixed ſalt in the blood, and that obtainable by mere calcination and lixi- " viation, this inſtance doth ſufficiently ſhew: and indeed all the parts of a hu- " man body do yield it, though not in great abundance. I do remember a late " objection made in this place againſt this doctrine, which was taken from a burnt " hart's-horn, it being denied, that it yielded any fixed ſalt. This occaſioned me " to lixiviate ſome, that I bought ready calcined; it was done calcined, ſo that " I did nothing elſe to it but only powder and lixiviate it, of which operation this " ſalt was the product.

" Having made theſe trials in beaſts, I thought it good to make an eſſay upon " man, and out of a pint of *ſerum* found ℥v. ʒj. of phlegm, ſp. ℥vi, ſal fixum ℈ii; " but neither volatile ſalt nor oil. I queſtion, if the perſons had been examined, " from which the ſerum were taken, whether their diſeaſes might not give ſome " light to the reaſon of this difference. But of the *grumus* of this blood ℥x. yielded " phlegm ℥iv. extract ℥vj. out of which by retort in ſand I drew ſp. ℥iij. oil ℥. " vol. ſalt. ʒij. the cap. mort. being ℥j. ʒij. yielded but gr. viii of fixed ſalt. I had " a deſign of further purſuing theſe experiments, but have been prevented by " important occaſions; ſo that I am fain to proceed upon what I have already " done.

" By the way let me obſerve, that as the proportions of the parts vary in theſe " two liquors, ſo do the other phænomena. For when you diſtil the *ſerum*, af- " ter the drawing off of the phlegm, you will find the extract pretty tough and " viſcid, much after the nature of other gellies; but the grumus, when diſtilled, " groweth very friable, unleſs it be in ſome places, where the ſerum hath been " detained in it. Alſo, if in ſeparating the ſerum from the grumus, you let any of " the red part accompany the grumus, which is hardly avoidable, unleſs you reſolve " to loſe much of your ſerum, then you ſhall upon diſtillation find that red part " gotten to the very bottom of the maſs, and there concreted by itſelf, as being " heavier than the other, and leſs miſcible than at firſt one would imagine.

" It is yet further obſervable, that this whole maſs is no longer to be kept

"mixed together than whilst it is kept in that posture by heat and motion; for "whenever it cooleth in the porringer it doth separate: I say *motion* and *heat* "do concur to the preservation of the mixture: either is sufficient to do it; of "which we may give many instances. For a digestive heat alone hath kept blood, "that was sealed up in a hermetical glass, in its usual fluidity, a month together; "and in the body of a man alive, I have known the blood to be as cold as rock-"water; yet its circulation kept it fluid. Yet as complete as the mixture seemeth "to be in the vessels, it is plain, that percolation maketh a separation of its parts; "which is visible in all the percolations in the kidneys, glandules, stomach, guts, "&c. and in all other places, where either nutrition or excretion is concerned; "which thing, if well weighed, may give us occasion of considering the whole "doctrine of nutrition and of secretions that attend it, and consequently of in-"quiring, what those parts of the blood are, which do immediately contribute "to nutrition, and of what parts. We know the old division of parts into san-"guineous and spermatic, the latter of which some of the speculative of this "age would have to be nourished only out of the nerves, others more probably "out of the serum of the blood, having an influence of the succus nervosus added "to it, but the sanguineous parts e grumo sanguinis. The occasion of the dis-"tinction was given by the redness, that appeareth in the viscera and muscles, and "the paleness, that happened in all the rest; which notwithstanding is but the ef-"fect of negligence in examination: for if we do carefully wash any muscle, or "the liver itself, by injections we shall find, that they are not red, and conse-"quently make a probable conjecture, that they are not nourished by that red "part of the blood. But on the other side, if that red part be not nutritious, "it will be hard to assign the use of it, whether it be the oily part and fuel for "the flame, that is by many supposed to be in the blood, or what else it may be "intended for. The notion of a flame being false in the foundation, as I have "elsewhere shewed, it will not be convenient to inquire further into it; but, since "I have at present undertaken the task, I shall be free in the delivery of my own "thoughts concerning this matter; which that I may do with the more advan-"tage, I shall take notice, that this redness is not in itself essential to blood, there "being many animals, that have it not, and are therefore called exanguious, "and the first formation of a body is probably complete before any redness ap-"pear in the fœtus; which if compared with what I said of the viscera, may "give cause of conjecture, that the red part is only the effect of the long digestion "of the blood, which boiling the salts and oil together doth produce the redness "we find, it being the extremity of coction in the blood; and being separated "from the blood by the liver, proves the matter, out of which choler is made. "Now it is true, that choler is of a colour less saturated than this red blood; but "the reason of that is not hard to give: for the spleen, if we may believe MALPIG-"HIUS, doth supply a ferment, which being joined to the blood in the porta, "may dispose it to that colour; and so much the rather, if the glandules, of "which the liver consisteth, do contribute any thing to it. It is worth our pains "to consider, that the liver doth perform two distinct excretory offices, one by "the pori bilarii of choler, another by the lymphæducts of serum. The lym-"phatics are more copious here than in any other part of the body, and, which is "to me the most remarkable circumstance, do in the extremity of their trunks

"inosculate

" inosculate with the pori bilarii; which cannot be said of any two distinct sort " of vessels, that carry distinct liquors in them throughout the whole body: the "·truth of which is easily manifested by injections, which, if cast into the pori " bilarii, do not only fill the vena cava (which was SYLVIUS's observation) but " the lymphæducts also with the same liquor, viz. milk and water, &c. that is " injected without mixing it with the blood: whereas, if we inject into the ar- " tery or the porta, no such thing will succeed; but it is also observable enough " without injections: the very lymphatics, after the death of a dog, if he lie twenty- " four hours, will turn yellow; and whereas in that animal the liquor of them " is sour, it will grow bitter, a manifest sign that they have received a tincture " from the bilious vessels. A further inquiry into this matter, viz. how one and " the same liver maketh a double secretion, and by what glands or other colatory " vessels these works are performed, will be the business of another discourse, " when I shall treat of the bile professedly. It is sufficient here briefly to take " notice, what becometh of this red part of the blood, viz. that in the liver it " meets with such ferments, whither lienous or lymphatic, as separates it from " the blood into the vessels of the gall. The remainder then will be the subject " of our present disquisition, which, in contradistinction to the red, I have called " serum; the quantity of which, if we well attend to it, we shall find to bear a " far greater proportion to the red than we have been hitherto aware; for of the " cake, that appeareth in it, a great part is serum, only imprisoned in the viscous " tenacity, that ariseth from the oil and salt, which in the crassament, that re- " mains upon the drawing off of the phlegm in balneo, is very distinguishable; " as also by other circumstances.

" This *serum* I know not to what more fitly to resemble than to the materia " prima of ARISTOTLE; a thing that is actually nothing, but potentially all things. " VAN. HELMONT calleth it latex, and describeth it to be *humor fatuus & insipidus* " *& concurrens viarum socius*; an insipid liquor, void, as he thought, of any noble " parts, only the companion, or rather vehicle of the blood, which served to " dilute it in its motions, to swallow up and devour its salts, to wash them off " from any part, where they were fixed and coagulated (which he gave for the rea- " son of humours and catharrs) and at length to carry them off by the kidneys, " and the pores of the skin. All this is true; but not all the truth: for this la- " tex, thus described, can mean no more than the phlegm of the serum, which is " first drawn off in balneo; whereas the serum, as we have contradistinguished " it to the grumus, contains a great variety of parts, as hath been already shewed; " these parts being the products of the nourishment eaten, and the materials out " of which all the parts of the body, and all the excrements of the second and " third concoction are made: nay, this serum is the proveditor-general of the " body, the instrument of all the concoctions in it. To explain which, I " shall first begin with the concoctions: the first being that of the ventricle, " I have elsewhere discoursed at large, and shewed that its chief instrument is, " first, the saliva, which is but part of the serum separated into the mouth by " the salivary glands, and then the addition of fresh serum in the ventricle de- " rived into it from the glandulous coat thereof. Here the first solution is made, " which being a confused mixture of alimentary and excrementitious parts, want-

"eth both a further digestion, and also a separation. To this end, we find still "more serum thrown upon it in the guts, both by the great channel of the ductus pancreaticus, and also by the lesser oozings of all the springy pores of the "glandulous tunicle of the guts, which promote the former, and also the addition of the bilis, which being mixed with this mass, doth coagulate with whatsoever is acid, and maketh it a solid body; whilst what is not acid evades its "efficacy, and keeping itself liquid, is squeezed up into the venæ lacteæ. This "remark obligeth me to take notice of a great mistake of our modern hypothesis-mongers, who have unanimously imputed the concoction of the ventricle to "an acid juice; whereas it is notorious to a man, that well considereth it, that "this acidity is not the cause, but the effect of concoction, as it is visibly the "effect of fermentation in any other liquors, where no acid body was ever added "to them, as we see not only in wines, beer, &c. where, by careful occlusion, "the liquors are preserved long in the vessels ere they come to it; but in barley "water or broth, or any mixed liquor, that is permitted to ferment of itself, it "will the sooner fall out, if it be placed in a convenient digesting heat. Now "it is most sensible to any man in health, that his saliva is insipid, and so is the "succus pancreaticus of a man, which indeed is in all animals proportionable to "the saliva. It is as sensible, that where the saliva is insipid, the concocted mass "of the stomach is acid, and yet not thin enough, nor otherwise fit by its mixture "with excrement to pass much of it up the lacteæ of the stomach itself; yet that "some part passeth immediately even that way (viz. the most subtil and tenacious "particles of the nourishment) may be judged from the vasa lactea, which do descend from the back side of the ventricle down into the receptaculum by a short "and strait road; which vessels, though not commonly acknowledged, have "been guessed at by many writers, and seen by myself; but the main bulk of it "passeth into the guts, where it meeteth with its two liquors aforesaid; one of "the same nature with the saliva derived from the pancreas and glands of the "guts, the other from the vesica fellea. These two liquors, how contrary soever "they have been represented to be by SYLVIUS, de GRAAF, &c. do not immediately act upon each other, which is from thence demonstrated, viz. that "they often in men, and alway in horses and deer, do enter into the guts by one "and the same ductus, which, if they had so immediate operation upon each "other, would defeat all efficacy they might have upon the juices, for whose "service they are designed. But, on the contrary, we find quite other phænomena, viz. the present attenuation of all the juices in the duodenum, by the "copious addition of the succus pancreaticus, which being yet sweet, doth not "act upon the bile, or the bile upon it, but by degrees, as the acidities, which "are consequent to concoction, do coagulate with that bile, and make a solid "excrement. But this is not all, that is performed upon this nutritious juice; for "the serum is yet again cohobated upon it, if I may use the expression, in receptaculo chyli. The manner and method of which is very pleasant to behold: "for it is a very true assertion of SYLVIUS, that the *ductus thoracicus*, commonly "so called, is rather to be termed *ductus lymphaticus*, it being perpetually filled "with lympha, and but sometimes only with chyle. He might have as well applied it to all the lymphatics of the lower belly, which do all of them receive

"chyle

" chyle at the time of the diſtribution of it, and at other times are found replete " with lympha; for, if you open a dog the fifth hour after his feeding, you will " find the chyle to poſſeſs not only all the meſaraics, but all the other lymphæ-" ducts and glands upon the iliac veſſels, and under the cava, and not only ſo, " but the whole maſs of ſuet, that is upon the loins, is likewiſe filled with it; " in which place it ſeems to be all extravaſated, and to gather up again afterwards " into veſſels to be conveyed to the receptaculum. There is an obſervable effect " of this extravaſation, viz. that the ſuet of the loins differs in ſeveral animals, " according to the difference of the milk and chyle: where they are full of but-" ter, and otherwiſe groſs, this fat is thick and ſolid, as in the ſuet of beeves, " ſheep, goats; but where they are thin, the fat is ſoft and greaſy, as may be " ſeen in the leaf of a ſwine, in horſes, dogs, men, &c. But whatever the muta-" tion is, that happens there, it deſcendeth at laſt to the receptacle, where it re-" ceiveth veſſels of good ſtore from the liver and elſewhere; ſo that, upon a full " imbibition of that, it is ſtill more and more fermented, and fitted to mingle " with the maſs in the veins. When it is once there, this ſerum, that goeth up " with it, and that of which the blood is principally compoſed, doth act upon it, " not making any ſuch momentary mutation of it, either in the heart, lungs, or " elſewhere, as ſome imagine; but gradually worketh it up into its own nature; " which being done, it becometh that nutritious body, whoſe parts have been " here repreſented to you in ſuch manner, as the fire doth explicate them. This " juice, as it hath been ſaid already, is indeed the main part of the whole maſs; " for I do not think the truly red grumus, if it could be actually ſeparated from " it, would be an eighth part of the whole. It is the matter, out of which all the " parts of the body, and all the juices of it, whether noble or ignoble, do re-" ceive their origin; which will be made more conſpicuous, if you follow it through " all the veſſels and organs; in all which it ſeemeth to me very conſpicuous, that " the red or groſſer part of the blood doth either by anaſtomaſes, or, (which " is tantamount to the) fitly adapted pores circulate round, preſerving the heat of " the body; but that, which enters into the minute pores, and is the true matter of " nutrition, is only the pellucid ſerum here mentioned. Of this I ſhall give you " many inſtances, and begin with the moſt noble, viz. the brain and nerves; " to both which what a great copia of large arteries and veins do tend, I have " elſewhere ſhewed, and many of this illuſtrious Society are well ſatisfied of by " their own obſervation. Theſe veſſels appearing large under the baſis of the brain, " and in the meninges, do ſend veſſels quite through both the cineritious cortex, " and alſo through the medullary white pulp of it, which may viſibly be found, " not only by injections of wax, ink, or the like, but alſo by the very tranſverſe " cutting of it, where the puncta ſanguinea do very manifeſtly diſcover them-" ſelves to be the ends of veſſels. Yet, after all this, theſe veſſels do not tranſ-" mit the leaſt drop of their red grumous part into it, or, if at any time it do, " it is death to the patient: from whence it is plain, that there are a ſecondary " ſort of veſſels or pores, call them what you will, which do percolate from it " that ſerous matter, out of which all the juice is made. It is true, that the cor-" tex hath a little yellowiſh ſtain, which intimates to us a faint tincture from the " red; but it is ſo ſmall, that the diluteneſs of it ſufficiently argueth, that the " maſs of blood doth not paſs through it. The like may be ſaid of the medulla

" ſpinalis

" and the nerves; all which have copious and large vessels every where playing " about them, to give a copious supply of such juices, as are largely expended in " them, for the use of both motion and nutrition, and other actions of life: but " there also, unless it be the cineritious part, which in the spinal marrow is hid- " den as it were in the center, there is not the least tincture of blood, much less " in the nerves themselves. But the case is every whit as evident in the glandules, " which how copiously they do separate serum from the mass of blood, he must " be a novice in anatomy that doth not know: yet it is as plain, that they have " not the least tincture of red blood; and though the sanguineous vessels do in " some places copiously insert themselves with large branches into them, as it is " most visible in the glandulous coat of the stomach and guts, yet, by a great ar- " tifice of nature, the communications are so commodiously contrived, that no- " thing of the red grumus doth extravasate into them, but is readily carried off " by the veins leaving only its serum behind it. The most noble instance, that I " find of this kind, is that of the most noble of glandules, I mean the testicle, " where so elaborate a separation of serum is made, and improved into so noble " a juice, that even here also, how carefully the red grumus is avoided by nature, " and what a great mischief it is to it when it happens, I leave to all experi- " enced men to judge. Nay, we see, that in the gonnorhæa itself, when there " is so copious an expence of serum, no blood usually entereth the gland, or, if " by the overweakness or distention of the vessels, it chance to be admitted, we " see what inflammations and dangerous tumours it doth produce. To say the " truth, if we well consider the nature of a gonnorhæa, we shall find it to be the " same thing to the testicle, that a diabetes is to the kidneys, viz. a fluor of the " serum sanguinis being by the venereal infection made thinner and sharper, which " copiously venteth itself that way. If it were any nobler juice, it were impos- " sible, that the strength of nature could bear it, where the flux is so large and " long continued; whereas we find, that many men bear great gonnorhæas to " some space of years, without any great diminution of strength. The parallel " diabetes is but the same thing in another place; only in that disease the ex- " pence is so very copious, that the treasure of the blood is too much exhausted " by it, and consequently perpetually afflicteth the patient with weakness and " fainting, because the brain, nerves, and other parts are defrauded of their due " supplies. Yet in all this there is no expence of the red grumus, but a mere per- " colation of pellucid serum.

" As to the other viscera, the liver seemeth very suspicious, as being so deeply " dyed with red, which the rather happens, because it is the place, where the red " mass is principally brought, and where it is concocted into bilis. But as to the " parenchyma of that also, if it be duly examined, we shall find, that in all " young animals it is pale, till too much passage of the red hath stained it, and " in the oldest body, a good syringe and fair water will wash off all that stain, " and shew it to be what it is, viz. a glandulous body made out of the serum of " the blood, and copiously separating serum from it.

" The same dilution by a syringe will shew the same thing as to the muscles of " the body; all of which in young things are pale, and in a calf white; which

" could

"could not be, if it were made of red blood; but when by degrees the frequent "circulation of the blood through the greater pores hath stained it, will, by the "means aforesaid, be brought to itself, and shew, that the parts of it are all a "confection out of the serum. For it is not the passage of the blood through "the greater pores, that immediately nourisheth; but the depositing of a subtile "juice in the minuter pores, into which the main blood never entereth. This "the ancients called cambium, ros, & gluten; and, if I were at leisure to con-"sider the whole history of nutrition, I could, from the nature of the serum, thus "conveyed into the pores, and of the fibres themselves, in which those pores "are excavated, give you a satisfactory account of the growth, status, and de-"cay of animals; of which I have already said something briefly in another "place.

"The only suspicious part in the body is the spleen, which doth appear at "the first sight a grumous body; but even that also is upon much dilution found "to consist chiefly of serum, if not totally; and if any thing of the red be spent "upon it, it is a peculiar case, in order to a peculiar ferment, which is after-"wards to be exercised in the liver for the separation of gall.

"The bones, membranes, gristles, ligaments, tendons, which are the only "remaining parts of the body, are out of dispute.

"I have thus far treated of the serum, both as the efficient cause of concoction, "and as the material cause of nourishment in all the parts of the body. The next "thing to be attempted is, to explain the manner of its conversion into nutri-"ment of parts, where the salts, sulphurs, &c. will be considered, and the man-"ner of its separating excrements; as also the several degenerations of it in mor-"bid cases."

Dr. Needham was desired to pursue the work, which he had prescribed himself.

With his discourse he left with Mr. Hooke eighteen glasses for the repository, containing the phlegm, spirits, salts, and oils of the *serum* and *grumus* of the blood, as he had analysed them himself.

Mr. Oldenburg produced and read a letter in French to himself, from Monf. Constantine Huygens Zuylichem, senior, dated at the Hague $\frac{16}{26}$ November, 1675 [m], accompanied with a little book in 8vo, in Low Dutch, by Herman Busschoff concerning the gout [n], presented to the Society by Monf. Huygens. It contained a new method of curing the gout by a factitious substance called *moxa*, prepared out of a dried herb, not named in the book; but

[m] Letter-book, vol. vii. p. 277.

[n] An English translation of this book was published at London, 1676, in 8vo, under the title of *Two Treatises; the one medical of the Gout by* Herman Busschoff, &c. See Philos. Transact. vol. xi. nº 125. p. 621.

this prepared subſtance was ſaid to be at Utrecht, at the houſe of the brother of the ſaid BUSSCHOFF.

Mr. OLDENBURG was deſired to procure ſome of this *moxa*, and to get the book tranſlated into England as ſoon as poſſible, and to give the Society an account of the contents of it at their next meeting.

November 29. At a meeting of the COUNCIL were preſent

The lord viſcount BROUNCKER, preſident,

Sir JOHN BANKES,	Mr. COLWALL,
Sir WILLIAM PETTY,	Mr. HOSKYNS,
Sir ROBERT SOUTHWELL,	Mr. HILL,
Mr. HENSHAW,	Mr. OLDENBURG.

It was ordered, that Sir JOHN BANKES, Sir JONAS MOORE, Dr. CROUNE, Mr. COLWALL, Mr. HILL, and Mr. HOOKE, or any two or more of them, whereof Mr. COLWALL to be one, do take care to get the poſſeſſion of the weſt or white gallery in Greſham College, to fit it for a repoſitory, and to remove thither with all poſſible ſpeed what is in the repoſitory of the Society: and

That it be recommended to the care of Dr. KING, to ſolicit the executors of the late Dr. WILLIS for the payment of his arrears to the Society, amounting to twenty pounds and eleven ſhillings, as appeared from the treaſurer's book.

The committee of the council for auditing the treaſurer's accounts made their report to the council [o].

November 30. being the anniverſary election of the Society, there were fifty members preſent.

Before they proceeded to election, the lord biſhop of Saliſbury, who was then in the chair, as vice-preſident, the preſident being prevented from attending by an unexpected impediment, propoſed for candidate GEORGE lord viſcount HALIFAX, who by reaſon of his quality was immediately put to the ballot, and unanimouſly elected.

Then the committe of the Society for auditing the treaſurer's accounts made their report, as follows:

" At a committee of the Royal Society for auditing the treaſurer's accounts " November 30, 1675, we find Mr. COLWALL the treaſurer Debtor.

	l.	s.	d.
" To monies he hath received on the ſeveral quarterly payments of " the Society from 19th November, 1674, to 25th November, " 1675.	184	7	6

[o] That report is omitted in the Council-book.

" To

	l. s. d.
"To monies received more of Dr. WALLIS in part of his arrear, " paid by my lord BROUNCKER, in consideration of a lecture he " read at the Society for his lordship, 12th November, 1674	5 17 0
"To monies more of my lord BROUNCKER for a lecture read by " Dr. GREW for his lordship, 28th October, 1675. - -	4 0 0
"To money received of the earl of AYLESBURY, for a lecture to be " read - - - - - - -	2 0 0
"To money received of Sir JOHN LOWTHER for the like purpose -	2 0 0
"To money received for admissions - - -	6 0 0
"To monies he received out of the chest - -	400 0 0
"To balance of his last account, ending 30th November, 1674	25 16 7
	£ 630 1 1

"We find him creditor

	l. s. d.
"By the monies he hath paid to the use of the Society, as by the exa- " mination of his vouchers doth appear - - -	595 3 8
"By balance resting in cash in his hands - - -	34 17 5
	£ 630 1 1

"Signed ROBERT REDDING,
" THEODORE HAAK,
" ROBERT HOOKE."

This being done, there was read an order, lately made by the council, concerning the leaving some members out of the list printed for this election-day; which order was as follows:

"November 20th, 1675.

"Ordered,

"That the president or his deputy be desired to intimate to the Society, on the " approaching anniversary election-day, that they could not but take notice of " some persons left out of the list; that this was done, because they were found " not to have performed their obligation to the Society: and that therefore the " council intended to proceed against them according to statute."

These persons were

Dr. BRUCE,	Dr. LOWER,
Mr. CARKESSE,	Sir THO. NOTTE,
Dr. DOWNS,	Mr. SLINGESBY,
Col. COLEPEPPER,	Sir PETER PETT:

 After

After this the Society proceeded to election, by which there were continued of the council for the year ensuing

The lord viscount BROUNCKER,
The earl marshal,
The earl of Aylesbury,
The lord bishop of Salisbury,
Sir JOSEPH WILLIAMSON,
Sir JOHN BANKES,
Sir ROBERT SOUTHWELL,
Mr. HENSHAW,
Mr. COLWALL,
Mr. HILL,
Mr. OLDENBURG.

The ten new members of the council were

The lord bishop of Chester,
Sir PAUL NEILE,
Sir CYRIL WYCHE,
Sir JONAS MOORE,
Dr. PELL,
Dr. HOLDER,
Dr. WALTER NEEDHAM,
Dr. CROUNE,
Dr. GREW,
Mr. MILLES.

Out of the council were elected for officers

The lord viscount BROUNCKER, president.
Mr. COLWALL, treasurer.
Mr. HENSHAW, Mr. OLDENBURG, } secretaries.

Several months before this election died a very considerable member of the Society, JONATHAN GODDARD, M. D. who was son of Mr. HENRY GODDARD, a ship carpenter at Deptford in Kent, and born at Greenwich in that county, in the year 1617 [p]. In the beginning of the year 1632, at fifteen years of age, he was admitted commoner of Magdalen Hall in Oxford, where continuing till he was of standing for the degree of batchelor of arts, he left that house, and travelled abroad [q] for his improvement in the study of physic [r]. After his return to his own country, having taken the degree of batchelor of physic at Christ's College in Cambridge, November 7. 1640, he promised to obey the laws and statutes of the college of physicians in London. He proceeded doctor of physic at Catharine Hall in Cambridge, January 20th, $164\frac{2}{3}$ [s], at which time he was a practitioner at London [t]: and December 22 following admitted candidate of the college of physicians, of which he was chosen fellow, November 4, 1646, and appointed to read the anatomy lecture there March 4. $164\frac{6}{7}$ [u]. At that time he had lodgings in Woodstreet, in the city of London, where Dr. WILKINS, Dr. ENT, Dr. GLISSON, Dr. WALLIS, and other eminent men, met, to cultivate and improve the new philosophy, and laid the first foundation of the Royal Society [x]. Dr. GODDARD was

[p] He was fifteen years old in 1632, according to WOOD. Athen. Oxon. vol. ii. col. 537.
[q] Id. ibid.
[r] WARD's Lives of the Professors of Gresham College. p. 270.
[s] Ibid.
[t] WOOD, ubi supra.
[u] WARD, ubi supra.
[x] Dr. WALLIS's Account of his own life, printed

physician to the army raised by the parliament, and afterwards to OLIVER CROMWELL, whom he attended both into Ireland and Scotland. December 9. 1651, he was appointed by the parliament warden of Merton College in Oxford, upon the resignation of Sir NATHANIEL BRENT; and January 14. following was incorporated Dr. of physic in that university [y]. In 1652, CROMWELL, then in Scotland, being chancellor of the university of Oxford, did by an instrument, dated October 16. constitute Dr. GODDARD, together with Dr. JOHN OWEN, dean of Christ Church, Dr. WILKINS, warden of Wadham College, Dr. THOMAS GOODWIN, president of Magdalen, and PETER FRENCH, B. D. canon of Christ Church, or any three or more of them, to act as his delegates in all matters relating to grants or dispensations which required his assent [z]. In 1653 Dr. GODDARD was chosen singly to represent the university of Oxford in parliament, and soon after appointed one of the council of state [a]. He was elected professor of physic in Gresham College, November 7. 1655, in the room of Dr. THOMAS WINSTON then lately deceased [b]. He held the wardenship of Merton College till after the restoration, when he was removed by a letter from his majesty, dated July 3, 1660, who claiming the right of supplying that headship in the vacancy of the see of Canterbury, appointed Dr. EDWARD REYNOLDS, one of his chaplains, warden, as successor to Sir NATHANIEL BRENT, no notice being taken of Dr. GODDARD [c]. After this Dr. GODDARD settled himself in Gresham College, and was continued a fellow of the college of physicians by their new charter in 1663 [d]. Having been one of the earliest members of the Royal Society, he was appointed one of the council of it by the first charter of July 15, 1662, and the second of April 22, 1663, being extremely zealous and active in promoting the design of its institution. For being an accurate chemist, he employed his laboratory at the college in trying many experiments for the use of the Society, as well as for making his own medicines. He died suddenly of an apoplexy, which seized him at the end of Woodstreet in Cheapside, as he was returning from the company of some of his philosophical friends at the Crown Tavern in Bloomsbury, at eleven at night, March 24. 167$\frac{4}{5}$; and was the third day after interred in Great St. Helen's Church in Bishop's-gate-street [e], on the north side of the chancel, near the rails of the communion-table, without any monument or inscription [f]. He was master of a very curious and valuable library of books elegantly bound, which he designed to have given to the Royal Society, but, he dying without a will, they fell to his heir at law, his sister's son, a scholar of Caius College in Cambridge [g]. His character is represented to great advantage by Dr. SETH WARD, in the dedication to him of his book, intitled, *In Ismael. Bullialdi Astronomiæ Philolaicæ Fundamenta Inquisitio brevis*, printed at Oxford, 1653, in 4to. in which dedication he is highly commended for his extensive learning, skill in his profession, knowledge of public affairs, generous disposition, candor, affability, and benevolence to all good and learned men;

in Mr. HEARNE's Preface to his edition of LANGTOFT's Chronicle, vol. i. p. 161.

[y] WOOD and WARD, ubi supra.

[z] WOOD, Fasti Oxon. vol. ii. col. 98.

[a] Id. Athen. Oxon. ubi supra.

[b] WARD, ubi supra.

[c] Register of Merton College, cited by bishop KENNET, Register and Chronicle, p. 157. and WARD, p. 270, 271.

[d] GOODALL's Royal College of Physicians of London, p. 70.

[e] WOOD, Athen. Oxon. vol. ii. col. 538.

[f] WARD, p. 271.

[g] WOOD, Athen. Oxon. col. 538.

and

and for being the first Englishman who made telescopes. The like complements were paid him by Mr. EDMUND DICKENSON, fellow of Merton-College, in the dedication to him of his *Delphi Phœnicizantes*, printed in 1655. And Dr. WALLIS, in 1657, dedicated to him, and to Dr LANGBAINE, Dr. WILKINSON, and Dr. WILKINS, his *Mathesis universalis.* Besides those writings of his, which were communicated to the Royal Society, he published at London, in 1668, in 8vo. *A Discourse concerning Physic, and the many Abuses thereof by Apothecaries*; and in 1669, in 4to. *A Discourse setting forth the unhappy condition of the Practice of physic in London.* He left likewise at his death his *Lectures read at Chirurgeons-Hall*, and other pieces, in two volumes in 4to. prepared by him for the press [e]; together with *Arcana Medicinalia*, published at the end of the second edition of *Pharmacopœia Bateana*, by JAMES SHIPTON, apothecary, at London, 1691, in 8vo.

December 2. The lord viscount HALLIFAX was admitted.

HENRY HALL, Esq; was proposed candidate by Mr. Le HUNT.

Mr. Le HUNT produced and left with Mr. HOOKE for the repository an iron stone, of which, he said, there were great numbers to be found in Brecknockshire in the parish of Llhanelthy, yielding more iron than any common iron-ore.

Mr. OLDENBURG read the preface of the Dutch book lately published, sent over by Monf. de ZUYLICHEM, concerning the gout; which preface he has translated into English, containing the occasion, design, and import of that book.

He was desired to send for some of the remedy for the gout out of Holland, where it was said to be had; and to inquire particularly at what intervals of time the author of the book, who had been cured by that medicine, had been troubled with gouty fits, before he made use of this remedy.

Mr. HOOKE was of opinion, that the substance concealed by this author was a kind of spunk.

Mr. OLDENBURG read a letter to himself from Mr. FRANCIS JESSOP of Broomhall in Yorkshire, dated 18 November, 1675 [f], containing a farther account of the fulminating damps in the mines of Wingernorth, of which he had sent some relation [g]; together with an answer to several queries, that were sent him on that occasion.

Mr. HOOKE mentioned hereupon, that there were two sorts of damps; the one of a moist and gross nature, falling downwards; the other spirituous and very apt to catch fire and to flame: adding, that heretofore in a well on Bansteaddowns about three hundred feet deep, he had let down a candle burning to the depth of two hundred feet; but that letting it down deeper, the candle went out.

[e] Idem, ibid. [f] Letter-book, vol. vii. p. 174. It is printed in the Philos. Transact. vol. x. n° 119. p. 450. for November, 1675. [g] Ibid. n° 117. p. 391.

Mr. Hooke produced one of his contrivances of lamps formerly difcourfed of by him, which he explained to the Society, ferving to keep water as well as food for lamps at the fame hight, and being ufeful to keep a conftant degree of heat for hatching of eggs; as alfo to vary the degrees of heat, and to anneal glafs for toughnefs, and likewife to anneal iron to the foftnefs of lead, &c.

December 9. There was produced a manufcript of Mr. Newton, touching his theory of light and colours, containing partly an hypothefis to explain the properties of light difcourfed of by him in his former papers, partly the principal phænomena of the various colours exhibited by thin plates or bubbles, efteemed by him to be of a more difficult confideration; yet to depend alfo on the faid properties of light.

Of the hypothefis only the firft part was read, giving an account of refraction, reflection, tranfparency, and opacity; the fecond part explaining colours being referred to the next meeting.

The firft was as follows [h]:

" Sir,

" I have fent you the papers I mentioned, by John Stiles. Upon reviewing " them, I find fome things fo obfcure, as might have deferved a further explication " by fchemes; and fome other things, I guefs, will not be new to you, though al- " moft all was new to me when I wrote them. But as they are, I hope you will accept " of them, though not worth the ample thanks you fent. I remember, in fome " difcourfe with Mr. Hooke, I happened to fay, that I thought light was re- " flected, not by the parts of glafs, water, air, or other fenfible bodies; but by " the fame confine or fuperficies of the æthereal mediums, which refracts it, the " rays finding fome difficulty to get through it in paffing out of the denfer into " the rarer medium, and a greater difficulty in paffing out of the rarer into the " denfer; and fo being either refracted or reflected by that fuperficies, as the " circumftances they happened to be in at their incidence make them able or " unable to get through it. And, for confirmation of this, I faid further, that " I thought the reflection of light, at its tending out of glafs into air, would not " be diminifhed or weakened by drawing away the air in an air-pump, as it ought " to be, if they were the parts of air that reflected: and added, that I had not " tried this experiment, but thought he was not unacquainted with notions of " this kind. To which he replied, that the notion was new, and he would the " firft opportunity try the experiment I propounded. But upon reviewing the " papers I fend you, I found it there fet down for tried; which makes me recol- " lect, that about the time I was writing thefe papers, I had occafionally obferved " in an air-pump here at Chrift's-College, that I could not perceive the reflection " of the infide of the glafs diminifhed in drawing out the air. This I thought " fit to mention, leaft my former forgetfulnefs, through having long laid afide " my thoughts on thefe things, fhould make me feem to have fet down for cer- " tain what I never tried.

[h] Regifter, vol. v. p. 65.

" Sir,

" Sir, I had formerly purposed never to write any hypothesis of light and " colours, fearing it might be a means to engage me in vain disputes: but I hope " a declared resolution to answer nothing, that looks like a controversy, unless " possibly at my own time upon some by-occasion, may defend me from that " fear. And therefore considering, that such an hypothesis would much illustrate " the papers I promised to send you; and having a little time this last week to " spare, I have not scrupled to describe one, so far as I could on a sudden recol-" lect my thoughts about it; not concerning myself, whether it shall be thought " probable or improbable, so it do but render the papers I send you, and others " sent formerly, more intelligible. You may see, by the scratching and inter-" lining, it was done in haste; and I have not had time to get it transcribed, " which makes me say I reserve a liberty of adding it; and desire, that you would " return those and the other papers when you have done with them. I doubt " there is too much to be read at one time, but you will soon know how to " order that. At the end of the hypothesis you will see a paragraph to be in-" serted as is there directed: I should have added another or two, but I had not " time, but such as it is, I hope you will accept it. Sir, I am, &c.

Is. Newton.

" An Hypothesis explaining the Properties of Light, discoursed of in my se-" veral Papers.

" Sir,

" In my answer to Mr. Hooke, you may remember, I had occasion to say " something of hypotheses, where I gave a reason, why all allowable hypotheses " in their genuine constitution should be conformable to my theories; and said " of Mr. Hooke's hypothesis, that I took the most free and natural application " of it to phænomena to be this[1]: that the agitated parts of bodies, according " to their several sizes, figure, and motions, do excite vibrations in the æther of " various depths or bignesses, which being promiscuously propagated through that " medium to our eyes, effect in us a sensation of light of a white colour; but, " if by any means those of unequal bignesses be separated from one another, the " largest beget a sensation of a red colour; the least, or shortest, of a deep " violet; and the intermediate ones, of intermediate colours: much after the " manner that bodies, according to their several sizes, shapes, and motions, ex-" cite vibrations in the air of various bignesses, which, according to those big-" nesses, make several tones in sound, &c. I was glad to understand, as I ap-" prehend, from Mr. Hooke's discouse at my last being at one of your assem-" blies, that he had changed his former notion of all colours being compounded " of only two original ones, made by the two sides of an oblique pulse; and " accommodated his hypothesis to this my suggestion of colours, like sounds, " being various, according to the various bigness of the pulses. For this I take " to be a more plausible hypothesis than any other described by former authors, " because I see not how the colours of thin transparent plates or skins can be " handsomely explained, without having recourse to æthereal pulses: but yet I

[1] Transact. n° 88. p. 5088.

" like

" like another hypothesis better, which I had occasion to hint something of in the
" same letter in these words[k]:

" *The hypothesis of light's being a body, had I propounded it, has a much greater
" affinity with the objector's own hypothesis, than he seems to be aware of; the vibra-
" tions of the æther being as useful and necessary in this as in his. For, assuming the
" rays of light to be small bodies emitted every way from shining substances, those,
" when they impinge on any refracting or reflecting superficies, must as necessarily ex-
" cite vibrations in the æther, as stones do in water when thrown into it. And, sup-
" posing these vibrations to be of several depths or thicknesses, accordingly as they are
" excited by the said corpuscular rays of various sizes and velocities; of what use
" they will be for explicating the manner of reflexion and refraction; the production of
" heat by the sun-beams; the emission of light from burning, putrifying, or other sub-
" stances, whose parts are vehemently agitated; the phænomena of thin transparent
" plates, and bubbles, and of all natural bodies; the manner of vision, and the dif-
" ference of colours; as also their harmony and discord; I shall leave to their consi-
" deration, who may think it worth their endeavour to apply this hypothesis to the
" solution of phænomena.*

" Were I to assume an hypothesis, it should be this, if propounded more ge-
" nerally, so as not to determine what light is, farther than that it is something
" or other capable of exciting vibrations in the æther: for thus it will become
" so general and comprehensive of other hypotheses, as to leave little room for
" new ones to be invented. And therefore, because I have observed the heads
" of some great virtuosos to run much upon hypotheses, as if my discourses want-
" ed an hypothesis to explain them by, and found, that some, when I could not
" make them take my meaning, when I spake of the nature of light and colours
" abstractedly, have readily apprehended it, when I illustrated my discourse by
" an hypothesis; for this reason I have here thought fit to send you a descrip-
" tion of the circumstances of this hypothesis as much tending to the illustration
" of the papers I herewith send you. And though I shall not assume either this or
" any other hypothesis, not thinking it necessary to concern myself, whether the
" properties of light, discovered by me, be explained by this, or Mr. HOOKE's,
" or any other hypothesis capable of explaining them; yet while I am describ-
" ing this, I shall sometimes, to avoid circumlocution, and to represent it more
" conveniently, speak of it, as if I assumed it, and propounded it to be believed.
" This I thought fit to express, that no man may confound this with my other
" discourses, or measure the certainty of one by the other, or think me obliged
" to answer objections against this script: for I desire to decline being involved
" in such troublesome and insignificant disputes.

" But to proceed to the hypothesis: First, it is to be supposed therein, that
" there is an æthereal medium much of the same constitution with air, but far
" rarer, subtler, and more strongly elastic. Of the existence of this medium
" the motion of a pendulum in a glass exhausted of air almost as quickly as in

[k] Transact. nº 88. p. 5087.

" the open air, is no inconfiderable argument. But it is not to be fuppofed, " that this medium is one uniform matter, but compounded, partly of the main " phlegmatic body of æther, partly of other various æthereal fpirits, much after " the manner, that air is compounded of the phlegmatic body of air intermixed " with various vapours and exhalations: for the electric and magnetic effluvia, " and gravitating principle, feem to argue fuch variety. Perhaps the whole " frame of nature may be nothing but various contextures of fome certain æthe- " real fpirits, or vapours, condenfed as it were by precipitation, much after the " manner, that vapours are condenfed into water, or exhalations into groffer fub- " ftances, though not fo eafily condenfible; and after condenfation wrought into " various forms; at firft by the immediate hand of the Creator; and ever fince " by the power of nature; which, by virtue of the command, increafe and " multiply, became a complete imitator of the copies fet her by the protoplaft. " Thus perhaps may all things be originated from æther.

" At leaft, the elaftic effluvia feem to inftruct us, that there is fomething of " an æthereal nature condenfed in bodies. I have fometimes laid upon a table " a round piece of glafs about two inches broad fet in a brafs ring, fo that the " glafs might be about one eighth or one fixth of an inch from the table, and " the air between them inclofed on all fides by the ring, after the manner as if " I had whelmed a little fieve upon the table; and then rubbing a pretty while " the glafs brifkly with fome rough and raking ftuff, till fome very little fragments " of very thin paper, laid on the table under the glafs, began to be attracted and " move nimbly to and fro; after I had done rubbing the glafs, the papers would " continue a pretty while in various motions; fometimes leaping up to the glafs " and refting there a while; then leaping down and refting there; then leaping " up, and perhaps down and up again, and this fometimes in lines feeming per- " pendicular to the table; fometimes in oblique ones; fometimes alfo they would " leap up in one arch and down in another, divers times together, without " fenfibly refting between; fometimes fkip in a bow from one part of the glafs " to another without touching the table, and fometimes hang by a corner, and " turn often about very nimbly, as if they had been carried about in the midft " of a whirlwind, and be otherwife varioufly moved, every paper with a diverfe " motion. And upon fliding my finger on the upper fide of the glafs, though " neither the glafs, nor inclofed air below, were moved thereby, yet would the " papers, as they hung under the glafs, receive fome new motion, inclining this " way or that way, accordingly as I moved my finger. Now, whence all thefe " irregular motions fhould fpring, I cannot imagine, unlefs from fome kind of " fubtil matter lying condenfed in the glafs, and rarefied by rubbing, as water is " rarefied into vapour by heat, and in that rarefaction diffufed through the fpace " round the glafs to a great diftance, and made to move and circulate varioufly, " and accordingly to actuate the papers till it return into the glafs again, and be " recondenfed there. And as this condenfed matter by rarefaction into an æthe- " real wind (for by its eafy penetrating and circulating through glafs I efteem it " æthereal) may caufe thefe odd motions, and by condenfing again may caufe " electrical attraction with its returning to the glafs to fucceed in the place of " what is there continually recondenfed; fo may the gravitating attraction of the

" earth

" earth be caufed by the continual condenfation of fome other fuch like æthereal " fpirit, not of the main body of phlegmatic æther, but of fomething very " thinly and fubtilly diffufed through it, perhaps of an unctuous or gummy, " tenacious, and fpringy nature, and bearing much the fame relation to æther, " which the vital aereal fpirit, requifite for the confervation of flame and vital " motions, does to air. For, if fuch an æthereal fpirit may be condenfed in " fermenting or burning bodies, or otherwife coagulated in the pores of the earth " and water into fome kind of humid active matter, for the continual ufes of " nature, adhering to the fides of thofe pores, after the manner that vapours " condenfe on the fides of a veffel; the vaft body of the earth, which may be " every where to the very center in perpetual working, may continually condenfe " fo much of this fpirit, as to caufe it from above to defcend with great celerity " for a fupply; in which defcent it may bear down with it the bodies it pervades " with force proportional to the fuperficies of all their parts it acts upon; nature " making a circulation by the flow afcent of as much matter out of the bowels " of the earth in an aereal form, which, for a time, conftitutes the atmofphere; " but being continually buoyed up by the new air; exhalations and vapours rifing " underneath, at length (fome part of the vapours, which return in rain, excepted) " vanifhes again into the æthereal fpaces, and there perhaps in time relents, and is " attenuated into its firft principle: for nature is a perpetual worker, generating " fluids out of folids, and folids out of fluids, fixed things out of volatile, and " volatile out of fixed, fubtil out of grofs and grofs out of fubtil; fome things " to afcend, and make the upper terreftrial juices, rivers, and the atmofphere; and " by confequence, others to defcend for a requital to the former. And, as the " earth, fo perhaps may the fun imbibe this fpirit copioufly, to conferve his fhin- " ing, and keep the planets from receding further from him. And they, that " will, may alfo fuppofe, that this fpirit affords or carries with it thither the folary " fewel and material principle of light: and that the vaft æthereal fpaces between " us and the ftars are for a fufficient repofitory for this food of the fun and " planets. But this of the conftitution of æthereal natures by the by.

" In the *fecond* place, it is to be fuppofed, that the æther is a vibrating medium " like air, only the vibrations far more fwift and minute; thofe of air, made by " a man's ordinary voice, fucceeding one another at more than half a foot or a " foot diftance; but thofe of æther at a lefs diftance than the hundred thoufandth " part of an inch. And, as in air the vibrations are fome larger than others, " but yet all equally fwift (for in a ring of bells the found of every tone is heard " at two or three miles diftance, in the fame order that the bells are ftruck;) fo, " I fuppofe, the æthereal vibrations differ in bignefs, but not in fwiftnefs. Now, " thefe vibrations, befide their ufe in reflexion and refraction, may be fuppofed " the chief means, by which the parts of fermenting or putrifying fubftances, " fluid liquors, or melted, burning, or other hot bodies, continue in motion, are " fhaken afunder like a fhip by waves, and diffipated into vapours, exhalations, " or fmoke, and light loofed or excited in thofe bodies, and confequently by " which a body becomes a burning coal, and fmoke, flame; and, I fuppofe, " flame is nothing but the particles of fmoke turned by the accefs of light and " heat to burning coals, little and innumerable.

"*Thirdly*, as the air can pervade the bores of small glass pipes, but yet not so " easily as if they were wider; and therefore stands at a greater degree of rarity " than in the free aereal spaces, and at so much a greater degree of rarity as the " pipe is smaller, as is known by the rising of water in such pipes to a much " greater hight than the surface of the stagnating water, into which they are " dipped; so I suppose æther, though it pervades the pores of crystal, glass, " water, and other natural bodies, yet it stands at a greater degree of rarity in " those pores, than in the free æthereal spaces, and at so much a greater degree of " rarity, as the pores of the body are smaller. Whence it may be, that the spirit " of wine, for instance, though a lighter body, yet having subtiler parts, and " consequently smaller pores, than water, is the more strongly refracting liquor. " This also may be the principal cause of the cohesion of the parts of solids and " fluids, of the springiness of glass, and bodies, whose parts slide not one upon " another in bending, and of the standing of the mercury in the Torricellian " experiment, sometimes to the top of the glass, though a much greater hight " than twenty-nine inches. For the denser æther, which surrounds these bodies, " must croud and press their parts together, much after the manner that air " surrounding two marbles presses them together, if there be little or no air be-" tween them. Yea, and that puzzling problem; *By what means the muscles are* " *contracted and dilated to cause animal motion, may receive greater light from hence* " *than from any means men have hitherto been thinking on.* For, if there be any " power in man to condense and dilate at will the æther, that pervades the " muscle, that condensation or dilation must vary the compression of the muscle, " made by the ambient æther, and cause it to swell or shrink accordingly. For " though common water will scarce shrink by compression, and swell by relax-" ation, yet (so far as my observation reaches) spirit of wine and oil will; and " Mr. Boyle's experiment of a tadpole shrinking very much by hard compres-" sing the water, in which it swam, is an argument, that animal juices do the " same. And as for their various pression by the ambient æther, it is plain, " that that must be more or less accordingly as there is more or less æther with-" in, to sustain and counterpoise the pressure of that without. If both æthers " were equally dense, the muscle would be at liberty, as if pressed by neither: " if there were no æther within, the ambient would compress it with the whole " force of its spring. If the æther within were twice as much dilated as that " without, so as to have but half as much springiness, the ambient would have " half the force of its springiness counterpoised thereby, and exercise but the " other half upon the muscle; and so in all other cases the ambient compresses " the muscle by the excess of the force of its springiness above that of the spring-" iness of the included. To vary the compression of the muscle therefore, and " so to swell and shrink it, there needs nothing but to change the consistence " of the included æther; and a very little change may suffice, if the spring of " æther be supposed very strong, as I take it to be many degrees stronger " than that of air.

" Now for the changing the consistence of the æther; some may be ready to " grant, that the soul may have an immediate power over the whole æther in " any part of the body, to swell or shrink it at will: but then how depends the

" muscular

" muſcular motion on the nerves? Others therefore may be more apt to think " it done by ſome certain æthereal ſpirit included within the *dura mater*, which " the ſoul may have power to contract or dilate at will in any muſcle, and ſo " cauſe it to flow thither through the nerves. But ſtill there is a difficulty, why " this force of the ſoul upon it does not take off the power of its ſpringineſs, " whereby it ſhould ſuſtain, more or leſs, the force of the outward æther. A " third ſuppoſition may be, that the ſoul has a power to inſpire any muſcle with " this ſpirit, by impelling it thither through the nerves. But this too has its " difficulties, for it requires a forcible intending the ſpring of the æther in the " muſcles, by preſſure exerted from the parts of the brain: and it is hard to " conceive, how ſo great force can be exerciſed amidſt ſo tender matter as the " brain is. And beſides, why does not this æthereal ſpirit, being ſubtil enough, " and urged with ſo great force, go away through the dura mater and ſkins of " the muſcle; or at leaſt ſo much of the other æther go out to make way for " this, which is crouded in? To take away theſe difficulties is a digreſſion; but " ſeeing the ſubject is a deſerving one, I ſhall not ſtick to tell you how I think " it may be done.

" Firſt then, I ſuppoſe, there is ſuch a ſpirit; that is, that the animal ſpirits " are neither like the liquor, vapour, or gas of ſpirit of wine; but of an æthereal " nature, ſubtil enough to pervade the animal juices, as freely as the electric, or " perhaps magnetic, effluvia do glaſs. And to know, how the coats of the " brain, nerves, and muſcles, may become a convenient veſſel to hold ſo ſubtil " a ſpirit, you may conſider, how liquors and ſpirits are diſpoſed to pervade or " not pervade things on other accounts than their ſubtilty. Water and oil per-" vade wood and ſtone, which quickſilver does not; and quickſilver metals, " which water and oil do not: water and acid ſpirits pervade ſalts, which oil " and ſpirit of wine do not; and oil and ſpirit of wine pervade ſulphur, which " water and acid ſpirits do not. So ſome fluids, as oil and water, though their " parts are in freedom enough to mix with one another, yet by ſome ſecret " principle of unſociableneſs they keep aſunder; and ſome, that are ſociable, may " become unſociable, by adding a third thing to one of them, as water to ſpirit " of wine, by diſſolving ſalt of tartar in it. The like unſociableneſs may be in " æthereal natures, as perhaps between the æthers in the vortices of the ſun and " planets; and the reaſon, why air ſtands rarer in the boxes of ſmall glaſs-pipes, " and æther in the pores of bodies, than elſewhere, may be, not want of ſub-" tilty, but ſociableneſs. And on this ground, if the æthereal vital ſpirit in a " man be very ſociable to the marrow and juices, and unſociable to the coats of " the brain, nerves, and muſcles, or to any thing lodged in the pores of thoſe " coats, it may be contained thereby, notwithſtanding its ſubtilty; eſpecially if " we ſuppoſe no great violence done to it to ſqueeze it out; and that it may not " be altogether ſo ſubtil as the main body of æther, though ſubtil enough to " pervade readily the animal juices, and that, as any of it is ſpent, it is continu-" ally ſupplied by new ſpirit from the heart.

" In the next place, for knowing how this ſpirit may be uſed for animal mo-" tion, you may conſider, how ſome things unſociable are made ſociable by the

" mediation

"mediation of a third. Water, which will not diſſolve copper, will do it, if "the copper be melted with ſulphur: aqua fortis, which will not pervade gold, "will do it by addition of a little ſal armoniac, or ſpirit of ſalt: lead will not "mix in melting with copper, but if a little tin or antimony be added, they mix "readily, and part again of their own accord, if the antimony be waſted by "throwing ſaltpeter or otherwiſe: and ſo lead melted with ſilver quickly per-"vades and liquefies the ſilver in a much leſs heat than is requiſite to melt the "ſilver alone; but, if they be kept in the teſt till that little ſubſtance, that re-"conciled them, be waſted or altered, they part again of their own accord. And, "in like manner, the æthereal animal ſpirit in a man may be a mediator between "the common æther and the muſcular juices, to make them mix more freely; "and ſo, by ſending a little of this ſpirit into any muſcle, though ſo little as to "cauſe no ſenſible tenſion of the muſcle by its own force; yet, by rendering the "juices more ſociable to the common external æther, it may cauſe that æther to "pervade the muſcle of its own accord in a moment more freely and copiouſly "than it would otherwiſe do, and to recede again as freely, ſo ſoon as this medi-"ator of ſociableneſs is retracted. Whence, according to what I ſaid above, "will proceed the ſwelling or ſhrinking of the muſcle, and conſequently the ani-"mal motion depending thereon.

"Thus may therefore the ſoul, by determining this æthereal animal ſpirit or "wind into this or that nerve, perhaps with as much eaſe as air is moved in open "ſpaces, cauſe all the motions we ſee in animals: for the making which motions "ſtrong, it is not neceſſary, that we ſhould ſuppoſe the æther within the muſcle "very much condenſed or rarified by this means, but only that its ſpring is ſo "very great, that a little alteration of its denſity ſhall cauſe a great alteration in "the preſſure. And what is ſaid of muſcular motion, may be applied to the mo-"tion of the heart, only with this difference, that the ſpirit is not ſent thither, "as into other muſcles, but continually generated there by the fermentation of "the juices, with which its fleſh is repleniſhed, and as it is generated, let out by "ſtarts into the brain through ſome convenient ductus to perform thoſe motions "in other muſcles by impreſſion, which it did in the heart by its generation. "For I ſee not, why the ferment in the heart may not raiſe as ſubtil a ſpirit out "of its juices, to cauſe theſe motions, as rubbing does out of a glaſs, to cauſe "electric attraction, or burning out of fewel, to penetrate glaſs, as Mr. Boyle "has ſhewn, and calcine by corroſion metals melted therein.

"Hitherto I have been contemplating the nature of æther and æthereal ſub-"ſtances by their effects and uſes; and now I come to join therewith the conſi-"deration of light.

"In the fourth place therefore, I ſuppoſe light is neither æther, nor its vibrating "motion, but ſomething of a different kind propagated from lucid bodies. They, "that will, may ſuppoſe it an aggregate of various peripatetic qualities. Others "may ſuppoſe it multitudes of unimaginable ſmall and ſwift corpuſcles of various "ſizes, ſpringing from ſhining bodies at great diſtances one after another; but "yet without any ſenſible interval of time, and continually urged forward by a

"principle

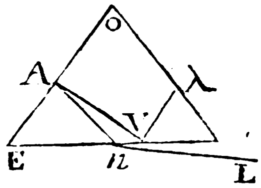
" principle of motion, which in the beginning accelerates them, till the resistence " of the æthereal medium equal the force of that principle, much after the " manner that bodies let fall in water are accelerated till the resistance of the wa- " ter equals the force of gravity. God, who gave animals self-motion beyond " our understanding, is, without doubt, able to implant other principles of mo- " tion in bodies, which we may understand as little. Some would readily grant " this may be a spiritual one; yet a mechanical one might be shewn, did not I " think it better to pass it by. But they, that like not this, may suppose light " any other corporeal emanation, or any impulse or motion of any other medium " or æthereal spirit diffused through the main body of æther, or what else they " can imagine proper for this purpose. To avoid dispute, and make this hypo- " thesis general, let every man here take his fancy: only, whatever light be, I " suppose, it consists of rays differing from one another in contingent circum- " stances, as bigness, form, or vigour; like as the sands on the shore, the waves " of the sea, the faces of men, and all other natural things of the same kind " differ; it being almost impossible for any sort of things to be found without " some contingent variety. And further, I would suppose it diverse, from the " vibrations of the æther, because (besides, that were it these vibrations, it " ought always to verge copiously in crooked lines into the dark or quiescent " medium, destroying all shadows; and to comply readily with any crooked pores " or passages, as sounds do,) I see not how any superficies (as the side of a glass " prism, on which the rays within are incident at an angle of above forty de- " grees) can be totally opake. For the vibrations beating against the refract- " ing confine of the rarer and denser æther must needs make that pliant super- " ficies undulate, and those undulations will stir up and propagate vibrations on " the other side. And further, how light, incident on very thin skins or plates " of any transparent body, should, for many successive thicknesses of the plate " in arithmetical progression, be alternately reflected and transmitted, as I find " it is, puzzles me as much. For, though the arithmetical progression of those " thicknesses, which reflect and transmit the rays alternately, argues, that it de- " pends upon the number of vibrations between the two superficies of the plate, " whether the ray shall be reflected or transmitted: yet I cannot see, how the " number should vary the case, be it greater or less, whole or broken, unless " light be supposed something else than these vibrations. Something indeed " I could fancy towards helping the two last difficulties, but nothing which I see " not insufficient.

" Fifthly, it is to be supposed, that light and æther mutually act upon one " another, æther in refracting light, and light in warming æther; and that the " densest æther acts most strongly. When a ray therefore moves through æther " of uneven density, I suppose it most pressed, urged, or acted upon by the me- " dium on that side towards the denser æther, and receives a continual impulse or " ply from that side to recede towards the rarer, and so is accelerated, if it move " that way, or retarded, if the contrary. On this ground, if a ray move " obliquely through such an unevenly dense medium (that is, obliquely to those " imaginary superficies, which run through the equally dense parts of the me- " dium, and may be called the refracting superficies) it must be incurved, as it

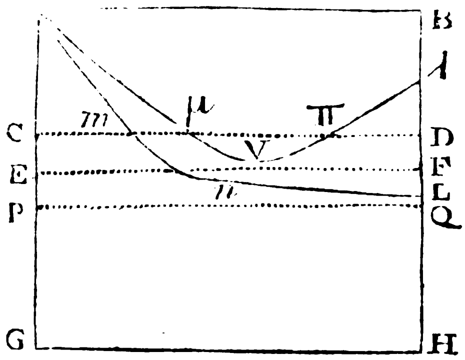
" is

“ is found to be, by obſervation in water [1], whoſe lower parts were made gradu-
“ ally more ſalt, and ſo more denſe than the upper. And this may be the ground
“ of all refraction and reflexion: for as the rarer air within a ſmall glaſs-pipe,
“ and the denſer without, are not diſtinguiſhed by a meer mathematical ſuper-
“ ficies, but have air between them, at the orifice of the pipe, running through
“ all intermediate degrees of denſity: ſo I ſuppoſe the refracting ſuperficies of
“ æther, between unequally denſe mediums, to be not a mathematical one; but
“ of ſome breadth, the æther therein, at the orifices of the pores of the ſolid body,
“ being of all intermediate degrees of denſity between the rarer and denſer æthe-
“ real mediums; and the refraction I conceive to proceed from the continual
“ incurvation of the ray all the while it is paſſing the phyſical ſuperficies. Now,
“ if the motion of the ray be ſuppoſed in this paſſage to be increaſed or dimi-
“ niſhed in a certain proportion, according to the difference of the denſities of the
“ æthereal mediums, and the addition or detraction of the motion be reckoned
“ in the perpendicular from the refracting ſuperficies, as it ought to be, the ſines
“ of incidence and refraction will be proportional according to what Des Cartes
“ has demonſtrated.

“ The ray therefore, in paſſing out of the rarer medium into the denſer,
“ inclines continually more and more towards paralleliſm with the refracting ſu-
“ perficies; and if the differing denſities of the mediums be not ſo great, nor the
“ incidence of the ray ſo oblique, as to make it parallel to that ſuperficies before
“ it gets through, then it goes through and is refracted; but if, through the afore-
“ ſaid cauſes, the ray become parallel to that ſuperficies before it can get through,
“ then it muſt turn back and be reflected. Thus, for inſtance, may be obſerved
“ in a triangular glaſs-priſm O E F, that the rays A *n*,
“ that ſend out of the glaſs into air, do, by inclining
“ them more and more to the refracting ſuperficies, emerge
“ more and more obliquely till they be infinitely oblique;
“ that is, in a manner parallel to the ſuperficies, which hap-
“ pens when the angle of incidence is about forty degrees;
“ and then, if they be a little more inclined are all reflected,



“ as at A V λ, becoming, I ſuppoſe, parallel to the ſuperficies before they can get
“ through it. Let A B D C repreſent the rarer medium; E F H G the denſer,
“ C D F E the ſpace between them, or re-
“ fracting phyſical ſuperficies, in which the
“ æther is of all intermediate degrees of
“ denſity, from the rareſt æther at C D,
“ to the denſeſt, at E F; A *m n* L a ray,
“ A *m* its incident part, *m n* its incurvation
“ by the refracting ſuperficies, and *n* L its
“ emergent part. Now, if the ray A *m* be
“ ſo much incurved as to become at its
“ emergence *n*, as nearly as may be, paral-
“ lel to C D, it is plain, that if that ray
“ had been incident a little more obliquely,



[1] See Mr. Hooke's Micrographia, where he ſpeaks of the inflexion of rays.

“ it

" it must have become parallel to C D, before it had arrived at E F, the further " side of the refracting superficies; and so could have got no nearer to E F, but " must have turned back by further incurvation, and been reflected, as it is re- " presented at A μ V λ. And the like would have happened, if the density " of the æther had further increased from E F to P Q; so that P Q H G might " be a denser medium than E F H G was supposed; for then the ray, in pass- " ing from *m* to *n*, being so much incurved, as at *n* to become parallel to C D " or P Q, it is impossible it should ever get nearer to P Q, but must at *n* be- " gin by further incurvation to turn back, and so be reflected. And because, if " a refracted ray, as *n* L, be made incident, the incident, A *m*, shall become the " refracted; and therefore, if the ray A μ V, after it is arrived at V, where I " suppose it parallel to the refracting superficies, should be reflected perpendicu- " larly back, it would return back in the line of incidence V μ A. Therefore " going forward, it must go forward in such another line, V π λ, both cases be- " ing alike, and so be reflected at an angle, equal to that of incidence.

" This may be the cause and manner of reflection, when light tends from the " rarer towards the denser æther: but to know, how it should be reflected, " when it stands from the denser towards the rarer, you are further to consider, " how fluids near their superficies are less pliant and yielding than in their more " inward parts; and, if formed into thin plates, or shells, they become much " more stiff and tenacious than otherwise. Thus, things, which readily fall in " water, if let fall upon a bubble of water, they do not easily break through it, " but are apt to slide down by the sides of it, if they be not too big and heavy. " So, if two well polished convex glasses, ground on very large spheres, be laid " one upon another, the air between them easily recedes, till they almost touch; " but then begins to resist so much, that the weight of the upper glass is too " little to bring them together so as to make the black, mentioned in the other " papers I send you, appear in the midst of the rings of colours: and, if the " glasses be plain, though no broader than a two-pence, a man with his whole " strength is not able to press all the air out from between them, so as to make " them fully touch. You may observe also, that insects will walk upon water " without wetting their feet, and the water bearing them up; also motes fal- " ling upon water will often lie long upon it without being wetted: and so, " I suppose, æther in the confine of two mediums is less pliant and yielding " than in other places, and so much the less pliant by how much the mediums " differ in density: so that in passing out of denser æther into rarer, when there " remains but a very little of the denser æther to be past through, a ray finds " more than ordinary difficulty to get through; and so great difficulty, where the " mediums are of very differing density, as to be reflected by incurvation, after " the manner described above; the parts of æther on that side, where they are " less pliant and yielding, acting upon the ray much after the manner that they " would do were they denser there than on the other side: for the resistance of " the medium ought to have the same effect on the ray, from what cause soever " it arises. And this, I suppose, may be the cause of the reflection of quick- " silver, and other metalline bodies. It must also concur to increase the reflective " virtue of the superficies, when rays tend out of the rarer medium into the

" denser: and, in that case therefore, the reflection having a double cause, ought " to be stronger than in the æther, as it is apparently. But in refraction, this ri- " gid tenacity or unpliableness of the superficies need not be considered, because " so much as the ray is thereby bent in passing to the most tenacious and rigid " part of the superficies, so much it is thereby unbent again in passing on from " thence through the next parts gradually less tenacious.

" Thus may rays be refracted by some superficies, and reflected by others, be " the medium they tend into, denser or rarer. But it remains further to be ex- " plained, how rays alike incident on the same superficies (suppose of crystal, glass, " or water) may be at the same time some refracted, others reflected. And for ex- " plaining this, I suppose, that the rays, when they impinge on the rigid resist- " ing æthereal superficies, as they are acted upon by it, so they react upon it and " cause vibrations in it, as stones thrown into water do in its surface; and that " these vibrations are propagated every way into both the rarer and denser me- " diums; as the vibrations of air, which cause sound, are from a stroke, but yet " continue strongest where they began, and alternately contract and dilate the æther " in that physical superficies. For it is plain by the heat, which light produces in " bodies, that it is able to put their parts in motion, and much more to heat and " put in motion the more tender æther; and it is more probable, that it com- " municates motion to the gross parts of bodies by the mediation of æther than " immediately; as for instance, in the inward parts of quicksilver, tin, silver, " and other very opake bodies, by generating vibrations, that run through them, " than by striking the outward parts only, without entering the body. The shock " of every single ray may generate many thousand vibrations, and by sending " them all over the body, move all the parts, and that perhaps with more mo- " tion than it could move one single part by an immediate stroke; for the vi- " brations, by shaking each particle backward and forward, may every time " increase its motion, as a ringer does a bell by often pulling it, and so at length " move the particles to a very great degree of agitation, which neither the simple " shock of a ray, nor any other motion in the æther, besides a vibrating one could " do. Thus in air shut up in a vessel, the motion of its parts caused by heat, " how violent soever, is unable to move the bodies hung in it, with either a trem- " bling or progressive motion: but if air be put into a vibrating motion by beat- " ing a drum or two, it shakes glass-windows, the whole body of a man, and " other massy things, especially those of a congruous tone: yea I have observed it " manifestly shake under my feet a cellared free-stone floor of a large hall, so as, " I believe, the immediate stroke of five hundred drumsticks could not have done, " unless perhaps quickly succeeding one another at equal intervals of time. Æthe- " real vibrations are therefore the best means by which such a subtile agent as " light can shake the gross particles of solid bodies to heat them: and so sup- " posing that light, impinging on a refracting or reflecting æthereal superficies, puts " it into a vibrating motion, that physical superficies being by the perpetual ap- " pulse of rays always kept in a vibrating motion, and the æther therein conti- " nually expanded and compressed by turns; if a ray of light impinge upon it, " while it is much compressed, I suppose it is then too dense and stiff to let the ray

" pass

" paſs through, and ſo reflects it; but the rays, that impinge on it at other times,
" when it is either expanded by the interval of two vibrations, or not too much
" compreſſed and condenſed, go through and are refracted.

" Theſe may be the cauſes of refractions and reflections in all caſes; but, for " underſtanding how they come to be ſo regular, it is further to be conſidered, " that in a heap of ſand, although the ſurface be rugged, yet if water be poured " on it to fill its pores, the water, ſo ſoon as its pores are filled, will evenly over- " ſpread the ſurface, and ſo much the more evenly, as the ſand is finer: ſo, al- " though the ſurface of all bodies, even the moſt poliſhed, be rugged, as I con- " ceive, yet where that ruggedneſs is not too groſs and coarſe, the refracting æthe- " real ſuperficies may evenly overſpread it. In poliſhing glaſs or metal, it is not " to be imagined, that ſand, putty, or other fretting powders, ſhould wear the " ſurface ſo regularly, as to make the front of every particle exactly plain, and " all thoſe plains look the ſame way, as they ought to do in well poliſhed bodies, " were reflection performed by their parts: but that thoſe fretting powders ſhould " wear the bodies firſt to a coarſe ruggedneſs, ſuch as is ſenſible, and then to a finer " and finer ruggedneſs, till it be ſo fine that the æthereal ſuperficies evenly over- " ſpreads it, and ſo makes the body put on the appearance of a poliſh, is a very na- " tural and intelligible ſuppoſition. So in fluids, it is not well to be conceived, that " the ſurfaces of their parts ſhould be all plain, and the plains of the ſuperficial parts " always kept looking all the ſame way, notwithſtanding that they are in perpetual " motion. And yet without theſe two ſuppoſitions, the ſuperficies of fluids could " not be ſo regularly reflexive as they are, were the reflexion done by the parts them- " ſelves, and not by an æthereal ſuperficies evenly overſpreading the fluid.

" Further, concerning the regular motion of light, it might be ſuſpected, whe- " ther the various vibrations of the fluid, through which it paſſes, may not much " diſturb it: but that ſuſpicion, I ſuppoſe, will vaniſh, by conſidering, that " if at any time the foremoſt part of an oblique wave begin to turn it awry, " the hindermoſt part, by a contrary action, muſt ſoon ſet it ſtraight again.

" Laſtly, becauſe without doubt there are, in every tranſparent body, pores of " various ſizes, and I ſaid, that æther ſtands at the greateſt rarity in the ſmalleſt " pores; hence the æther in every pore ſhould be of a differing rarity, and ſo " light be refracted in its paſſage out of every pore into the next, which would " cauſe a great confuſion, and ſpoil the body's tranſparency. But conſidering that " the æther, in all denſe bodies, is agitated by continual vibrations, and theſe vi- " brations cannot be performed without forcing the parts of æther forward and " backward, from one pore to another, by a kind of tremor, ſo that the æther, " which one moment is in a greater pore, is the next moment forced into a leſs; " and on the contrary, this muſt evenly ſpread the æther into all the pores not " exceeding ſome certain bigneſs, ſuppoſe the breadth of a vibration, and ſo make " it of an even denſity throughout the tranſparent body, agreeable to the middle " ſort of pores. But where the pores exceed a certain bigneſs, I ſuppoſe " the æther ſuits its denſity to the bigneſs of the pore, or to the medium within " it; and ſo being of a diverſe denſity from the æther that ſurrounds it, refracts

" or reflects light in its superficies, and so make the body, where many such in-
" terstices are, appear opake."

Some of the members taking particular notice, among other things, of an experiment mentioned in this hypothesis, desired, that it might be tried; viz. that having laid upon a table a round piece of glass, about two inches broad, in a brass ring; so that the glass might be one third part of an inch from the table; and then rubbing the glass briskly, till some little fragments of paper laid on the table under the glass began to be attracted, and move nimbly to and fro; after he had done rubbing the glass, the papers would continue a pretty while in various motions, sometimes leaping up to the glass, and resting there a while, then leaping down, and resting there, and then leaping up and down again, and this sometimes in lines seeming perpendicular to the table, sometimes in oblique ones; sometimes also leaping up in one arch, and leaping down in another divers times together, without sensibly resting between; sometimes skipping in a bow from one part of the glass to another, without touching the table, and sometimes hanging by a corner, and turning often about very nimbly, as if they had been carried about in the middle of a whirlwind; and being otherwise variously moved, every paper with a different motion. And upon sliding his finger upon the upper side of the glass, though neither the glass nor the inclosed air below were moved thereby, yet would the papers, as they hung under the glass, receive some new motion, inclining this or that way, according as he moved his finger.

This experiment Mr. NEWTON proposed to be varied with a larger glass placed farther from the table, and to make use of bits of leaf gold instead of papers; thinking, that this would succeed much better, so as perhaps to make the leaf gold rise and fall in spiral lines, or whirl for a time in the air, without touching either the table or glass.

It was ordered, that this experiment should be tried at the next meeting; and Mr. HOOKE promised to prepare it for that meeting.

Mr. OLDENBURG was desired to enquire by letter of Mr. NEWTON, whether he would consent, that a copy might be taken of his papers, for the better consideration of their contents.

Mr. OLDENBURG presented from Mr. MARTYN, the printer to the Society, Mr. WILLUGHBY's *Ornithologia*, printed at London, 1676, in fol.

December 16. Mr. NEWTON's experiment of glass rubbed to cause various motions in bits of paper underneath, was tried, but did not succeed in those circumstances, with which it was tried. This trial was made upon the reading of a letter of his to Mr. OLDENBURG, dated at Cambridge, 14th December, 1675 [m], in which he gives some more particular directions about that experiment.

The letter was as follows:

[m] Letter-book, vol. vii. p. 280.

The

"The notice you gave me of the Royal Society's intending to see the experi-
"ment of glass rubbed, to cause various motions in bits of paper underneath,
"put me upon recollecting myself a little further about it; and then remembring,
"that, if one edge of the brass hoop was laid downward, the glass was as near
"again to the table as it was when the other edge was laid downward, and that
"the papers played best when the glass was nearest to the table; I began to suf-
"pect, that I had set down a greater distance of the glass from the table than I
"should have done; for in setting down that experiment, I trusted to the idea I
"had of the bigness of the hoop, in which I might easily be mistaken, having
"not seen it of a long time. And this suspicion was increased by trying the ex-
"periment with an object glass of a telescope, placed about the third part of an
"inch from the table; for I could not see the papers play any thing near so well
"as I had seen them formerly. Whereupon I looked for the old hoop with its
"glass, and at length found the hoop, the glass being gone; but by the hoop I
"perceived, that, when one edge was turned down, the glass was almost the
"third part of an inch from the table, and when the other edge was down,
"which made the papers play so well, the glass was scarce the eighth part of an
"inch from the table. This I thought fit to signify to you, that, if the expe-
"riment succeed not well at the distance I set down, it may be tried at a less
"distance, and that you may alter my paper, and write in it the eighth part of an
"inch instead of $\frac{1}{4}$ or $\frac{1}{3}$ of an inch. The bits of paper ought to be very little,
"and of thin paper; perhaps little bits of the wings of a fly, or other light sub-
"stances, may do better than paper. Some of the motions, as that of hanging
"by a corner and twirling about, and that of leaping from one part of the glass
"to another, without touching the table, happen but seldom; but it made me take
"the more notice of them.

"Pray present my humble service to Mr. BOYLE, when you see him, and thanks
"for the favour of the converse I had with him at Spring. My conceit of tre-
"paning the common æther, as he was pleased to express it, makes me begin
"to have the better thoughts on that he was pleased to entertain it with a smile.
"I am apt to think, that when he has a set of experiments to try in his air-pump,
"he will make that one, to see how the compression or relaxation of a muscle will
"shrink or swell, soften or harden, lengthen or shorten it.

"As for registring the two discourses, you may do it; only I desire you would
"suspend till my next letter, in which I intend to set down something to be al-
"tered, and something to be added in the hypothesis."

It was ordered, that Mr. OLDENBURG should again write to Mr. NEWTON, and acquaint him with the want of success of his experiment, and desire him to send his own apparatus, with which he had made it: as also to enquire, whether he had secured the papers being moved from the air, that might somewhere steal in.

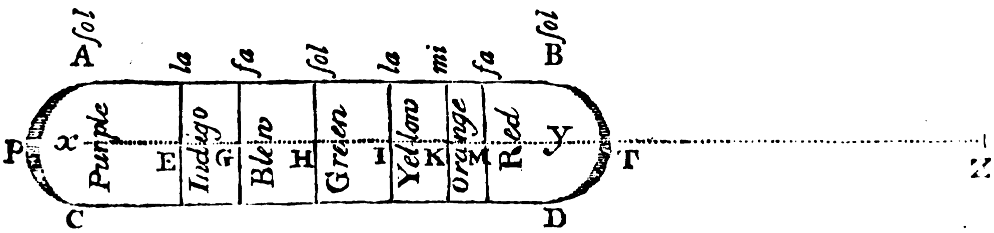
Hereupon the sequel of his hypothesis, the first part of which was read at the preceding meetings, was read to the end.

"Thus

"Thus much of refraction, reflection, transparency, and opacity; and now to "explain colours; I suppose, that as bodies of various sizes, densities, or sensations, do by percussion or other action excite sounds of various tones, and "consequently vibrations in the air of various bigness; so when the rays of "light, by impinging on the stiff refracting superficies, excite vibrations in the "æther, those rays, whatever they be, as they happen to differ in magnitude, "strength or vigour, excite vibrations of various bigness; the biggest, strongest, "or most potent rays, the largest vibrations; and others shorter, according to "their bigness, strength, or power: and therefore the ends of the capillamenta of "the optic nerve, which pave or face the retina, being such refracting superficies, when the rays impinge upon them, they must there excite these vibrations, which vibrations (like those of sound in a trunk or trumpet) will run "along the aqueous pores or crystalline pith of the capillamenta through the "optic nerves into the sensorum (which light itself cannot do) and there, I suppose, affect the sense with various colours, according to their bigness and mixture; the biggest with the strongest colours, reds and yellows; the least with "the weakest, blues and violets; the middle with green, and a confusion of "all with white, much after the manner, that in the sense of hearing, nature "makes use of aereal vibrations of several bignesses to generate sounds of divers "tones; for the analogy of nature is to be observed. And further, as the "harmony and discord of sounds proceed from the proportions of the aereal vibrations, so may the harmony of some colours, as of golden and blue, and the "discord of others, as of red and blue, proceed from the proportions of the æthereal. And possibly colour may be distinguished into its principal degrees, red, "orange, yellow, green, blue, indigo, and deep violet, on the same gro nd, "that sound within an eighth is graduated into tones. For, some years past, the "prismatic colours being in a well darkened room cast perpendicularly upon "a paper about two and twenty foot distant from the prism, I desired a friend "to draw with a pencil lines cross the image, or pillar of colours, where every "one of the seven aforenamed colours was most full and brisk, and also where he "judged the truest confines of them to be, whilst I held the paper so, that the said "image might fall within a certain compass marked on it. And this I did, partly "because my own eyes are not very critical in distinguishing colours, partly because another, to whom I had not communicated my thoughts about this matter, could have nothing but his eyes to determine his fancy in making those "marks. This observation we repeated divers times, both in the same and divers days, to see how the marks on several papers would agree; and comparing "the observations, though the just confines of the colours are hard to be assigned, "because they pass into one another by insensible gradation; yet the *differences* "of the observations were but little, especially towards the red end, and taking "means between those differences, that were, the length of the image (reckoned "not by the distance of the verges of the semicircular ends, but by the distance of "the centres of those semicircles, or length of the strait sides as it ought to be) "was divided in about the same proportion that a string is, between the end and "the middle, to sound the tones in the eighth. You will understand me best "by viewing the annexed figure, in which A B and C D represent the strait "sides, about ten inches long, A B C and B T D the semicircular ends, X and

"Y

“ Y the centres of those semicircles, X Z the length of a musical string double to



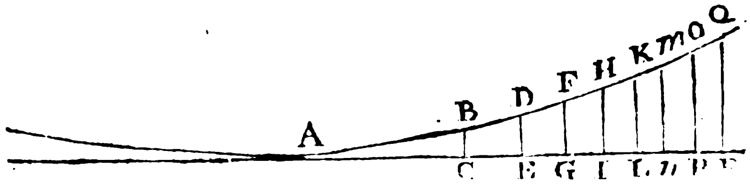
“ X Y, and divided between X and Y, so as to sound the tones expressed at the “ side (that is X H the half, X G and G I the third part, Y K the fifth part, “ Y M the eighth part, and G E the ninth part of X Y) and the intervals between “ these divisions express the spaces which the colours written there took up, every “ colour being most briskly specific in the middle of those spaces.

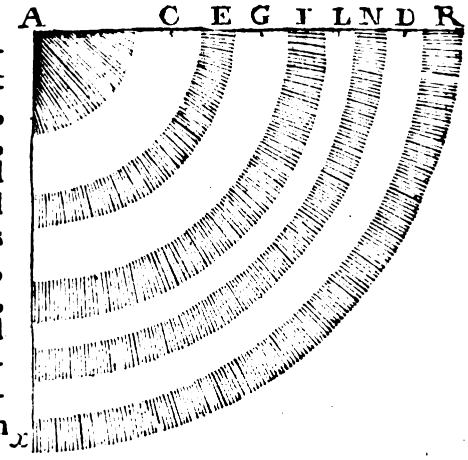
“ Now for the cause of these and such like colours made by refraction, the “ biggest or strongest rays must penetrate the refracting superficies more freely “ and easily than the weaker, and so be less turned awry by it, that is, less re- “ fracted; which is as much as to say, the rays, which make red, are least refran- “ gible, those, which make blue and violet, most refrangible, and others otherwise “ refrangible according to their colour: whence, if the rays, which come promis- “ cuously from the sun, be refracted by a prism, as in the aforesaid experiment, “ these of several sorts being variously refracted, must go to several places on an “ opposite paper or wall, and so parted, exhibit every one their own colours, “ which they could not do while blended together. And, because refraction only “ severs them, and changes not the bigness or strength of the ray, thence it is, “ that after they are once well severed, refraction cannot make any further changes “ in their colour.

“ On this ground may all the phænomena of refractions be understood: but to “ explain the colours made by reflections, I must further suppose, that, though “ light be unimaginably swift, yet the æthereal vibrations, excited by a ray, move “ faster than the ray itself, and so overtake and outrun it one after another. And “ this, I suppose, they will think an allowable supposition, who have been in- “ clined to suspect, that these vibrations themselves might be light. But to make “ it the more allowable, it is possible light itself may not be so swift, as some are “ apt to think; for, notwithstanding any argument, that I know yet to the con- “ trary, it may be an hour or two, if not more, in moving from the sun to us. “ This celerity of the vibrations therefore supposed, if light be incident on a thin “ skin or plate of any transparent body, the waves, excited by its passage through “ the first superficies, overtaking it one after another, till it arrive at the second “ superficies, will cause it to be there reflected or refracted accordingly as the con- “ densed or expanded part of the wave overtakes it there. If the plate be of such “ a thickness, that the condensed part of the first wave overtake the ray at the se- “ cond superficies, it must be reflected there; if double that thickness, that the “ following rarified part of the wave, that is, the space between that and the next

“ wave,

" wave, overtake it, there it muſt be tranſmitted; if triple the thickneſs, that the " condenſed part of the ſecond wave overtake it, there it muſt be reflected, and " ſo where the plate is five, ſeven, or nine times that thickneſs, it muſt be *reflected* " by reaſon of the third, fourth, or fifth wave, overtaking it at the ſecond ſuper- " ficies; but when it is four, ſix, or eight times that thickneſs, ſo that the ray " may be overtaken there by the dilated interval of thoſe waves, it ſhall be *tranſ- " mitted*, and ſo on; the ſecond ſuperficies being made able or unable to reflect " accordingly as it is condenſed or expanded by the waves. For inſtance, let " A H Q repreſent the ſuperficies of a ſpherically convex glaſs laid upon a plain " glaſs A I R, and A I R Q H the thin plane-concave plate of air between them, " and B C, D E, F G, H I, &c. thickneſſes of that plate, or diſtances of the " glaſſes in the arithmetical progreſſion of the numbers 1. 2. 3. 4. &c. whereof





" B C is the diſtance, at which the ray is over- " taken by the moſt condenſed part of the firſt " wave: I ſay, the rays incident at B, F, K, " and O, ought to be *reflected* at C, G, L, " and P, and thoſe incident at D, H, M, and " Q, ought to be *tranſmitted* at E, I, N, and " R; and this, becauſe the ray B C arrives " at the ſuperficies A C, when it is condenſed, " by the firſt wave that overtakes it; D E, " when rarified by the interval of the firſt and " ſecond; F G, when condenſed by the ſe- " cond wave; H I, when rarified by the in- " terval of the ſecond and third; and ſo on

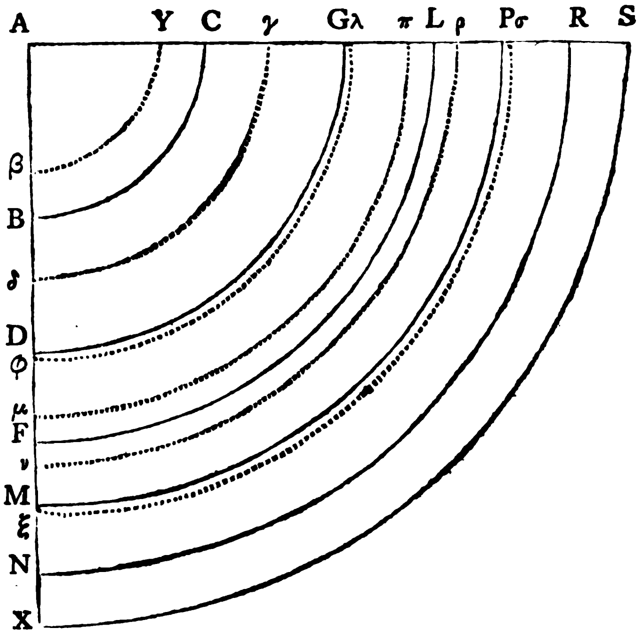
" for an indeterminate number of ſucceſſions; and at A, the center or contact of " the glaſſes, the light muſt be *tranſmitted*, becauſe there the æthereal mediums " in both glaſſes are continued as if but one uniform medium. Whence, if the " glaſſes in this poſture be looked upon, there ought to appear at A, the contact " of the glaſſes, a black ſpot, and about that many concentric circles of light and " darkneſs, the ſquares of whoſe ſemidiameters are to ſenſe and arithmetical pro- " greſſion. Yet all the rays, without exception, ought not to be thus reflected or " tranſmitted: for ſometimes a ray may be overtaken at the ſecond ſuperficies, " by the vibrations raiſed by another collateral or immediately ſucceeding ray; " which vibration, being as ſtrong or ſtronger than its own, may cauſe it to be " reflected or tranſmitted when its own vibration alone would do the contrary. " And hence ſome little light will be reflected from the black rings, which makes " them

" them rather black than totally dark; and some transmitted at the lucid rings, " which makes the black rings, appearing on the other side of the glasses, not so " black as they would otherwise be. And so at the central black spot, where the " glasses do not absolutely touch, a little light will be reflected, which makes the " spot darkest in the middle, and only black at the verges. For thus I have ob- " served it to be, by tying very hard together two glass prisms, which were ac- " cidentally (one of them at least) a very little convex, and viewing by divers " lights this black spot at their contact. If a white paper was placed at a little " distance behind a candle, and the candle and paper viewed alternately by re- " flection from the spot, the verges of the spot, which looked by the light of the " paper as black as the middle part, appeared by the stronger light of the candle " lucid enough, so as to make the spot seem less than before; but the middle part " continued as absolutely black in one case as in the other, some specks and streaks " in it only excepted, where I suppose the glasses, through some unevenness in " the polish, did not fully touch. The same I have observed by viewing the spot " by the like reflection of the sun and clouds alternately.

" But to return to the lucid and black rings, those rings ought always to ap- " pear after the manner described, were light uniform. And after that manner, " when the two contiguous glasses A Q and A R have been illustrated, in a dark " room, by light of any uniform colour made by a prism, I have seen the lucid " circles appear to about twenty in number, with many dark ones between them, " the colour of the lucid ones being that of the light, with which the glasses were " illustrated. And if the glasses were held between the eye and prismatic colours, " cast on a sheet of white-paper, or if any prismatic colour was directly trajected " through the glasses to a sheet of paper placed a little way behind, there would " appear such other rings of colour and darkness (in the first case between the " glasses, in the second, on the paper) oppositely corresponding to those, which " appeared by reflection: I mean, that, whereas by reflected light there appeared " a black spot in the middle, and then a coloured circle; on the contrary, by trans- " mitted light there appeared a coloured spot in the middle, and then a black circle, " and so on; the diameters of the coloured circles, made by transmission, equall- " ing the diameters of the black ones made by reflection.

" Thus, I say, the rings do and ought to appear when made by uniform light; " but in compound light it is otherwise. For the rays, which exhibit red and " yellow, exciting, as I said, larger pulses in the æther than those, which make " blue and violet, and consequently making bigger circles in a certain propor- " tion, as I have manifestly found they do, by illuminating the glasses successively " by the aforesaid colours of prism in a well darkened room, without changing " the position of my eye or of the glasses; hence the circles, made by illustrating " the glasses with white light, ought not to appear black and white by turns, as " the circles made by illustrating the glasses; for instance, with red light, appear " red and black; but the colours, which compound the white light, must display " themselves by being reflected, the blue and violet nearer to the center than the " red and yellow, whereby every lucid circle must become violet in the inward " verge, red in the outward, and of intermediate colours in the intermediate

" parts, and be made broader than before, ſpreading the colours both ways into " thoſe ſpaces, which I call the black rings, and which would here appear black, " were the red, yellow, blue, and violet, which make the verge of the rings, taken " out of the incident white light, which illuſtrates the glaſſes, and the green only " left to make the lucid rings. Suppoſe C B, G D, L F, P M, R N, S X, re- " preſent quadrants of the circles made in a dark room by the very deepeſt priſ-



" matic *red* alone; and Y β, γδ, " λ φ, π μ, ρ ν, σ ξ, the qua- " drants of like circles made " alſo in a dark room, by the " very deepeſt priſmatic *violet* " alone: and then, if the glaſ- " ſes be illuminated by open " day light, in which all ſorts " of rays are blended, it is ma- " nifeſt, that the firſt lucid " ring will be Y β B C; the ſe- " cond γ δ D G, the third, " λ φ F L, the fourth π μ M P, " the fifth ρ ν N R, the ſixth " σ ξ XS, &c. in all which " the deepeſt violet muſt be " reflected at the inward edges " repreſented by the pricked " lines, where it would be re- " flected were it alone, and the deepeſt *red* at the outward edges repreſented by " the black lines, where it would be reflected, were it alone; and all intermediate " colours at thoſe places, in order, between theſe edges, at which they would be re- " flected were they alone; each of them in a dark room, parted from all other " colours by the refraction of a priſm. And becauſe the ſquares of the ſemidia- " meters of the outward verges A C, A G, A L, &c. as alſo of A Y, A γ, A λ, " &c. the ſemidiameters of the inward are in arithmetical progreſſion of the num- " bers 1, 3, 5, 7, 9, 11, &c. and the ſquares of the inward are to the ſquares " of the outward (A Y^{9} to A C^{9}, A γ^{9} to A G^{9}, A λ^{9} to A L^{9}, &c.) as 9 to 14, " (as I have found by meaſuring them carefully and often, and comparing the " obſervations:) therefore the outward *red* verge of the ſecond ring, and inward " *violet* one of the third, ſhall border upon one another (as you may know by com- " putation, and ſee them repreſented in the figure) and the like edges of the third " and fourth rings ſhall interfere, and thoſe of the fourth and fifth interfere more, " and ſo on. Yea, the colours of every ring muſt ſpread themſelves ſomething " more both ways than is here repreſented, becauſe the quadrantal arcs here de- " ſcribed repreſent not the verges, but the middle of the rings made in a dark " room by the extreme violet and red; the *violet* falling on both ſides the pricked " arches, and *red* on both ſides the black line arches. And hence it is, that " theſe rings or circuits of colours ſucceed one another continually, without any

" intervening black, and that the colours are pure only in the three or four firſt
" rings, and then intervening and mixing more and more, dilute one another ſo
" much, that after eight or nine rings they are no more to be diſtinguiſhed, but
" ſeem to conſtitute an even whiteneſs; whereas, when they were made in a dark
" room by one of the priſmatic colours alone, I have, as I ſaid, ſeen above twenty
" of them, and without doubt could have ſeen them to a greater number, had I
" taken the pains to make the priſmatic colour more uncompounded. For by
" unfolding theſe rings from one another, by certain refractions expreſſed in the
" other [a] papers I ſend you, I have, even in day-light, diſcovered them to above
" an hundred; and perhaps they would have appeared innumerable, had the light
" or colour illuſtrating the glaſſes been abſolutely uncompounded, and the pupil
" of my eye but a mathematical point; ſo that all the rays, which came from
" the ſame point of the glaſs might have gone into my eye at the ſame obliquity
" to the glaſs.

" What has been hitherto ſaid of the rings, is to be underſtood of their appear-
" ance to an unmoved eye: but if you vary the poſition of the eye, the more
" obliquely you look on the glaſs, the larger the rings appear. And of this the
" reaſon may be, partly that an oblique ray is longer in paſſing through the
" firſt ſuperficies, and ſo there is more time between the waving forward and back-
" ward of that ſuperficies, and conſequently a larger wave generated, and partly,
" that the wave in creeping along between the two ſuperficies may be impeded and
" retarded by the rigidneſs of thoſe ſuperficies, bounding it at either end, and ſo
" not overtake the ray ſo ſoon as a wave, that moves perpendicularly croſs.

" The bigneſs of the circles made by every colour, and at all obliquities of the
" eye to the glaſſes, and the thickneſs of the air, or intervals of the glaſſes,
" where each circle is made, you will find expreſſed in the other papers I ſend
" you; where alſo I have more at large deſcribed, how much theſe rings inter-
" fere, or ſpread into one another; what colours appear in every ring, where
" they are moſt lively, where and how much diluted by mixing with the colours of
" other rings; and how the contrary colours appear on the back ſide of the glaſſes
" by the tranſmitted light, the glaſſes tranſmitting light of one colour at the ſame
" place, where they reflect that of another. Nor need I add any thing further of
" the colours of other thinly plated mediums, as of water between the aforeſaid
" glaſſes, or formed into bubbles, and ſo encompaſſed with air, or of glaſs blown
" into very thin bubbles at a lamp furnace, &c. the caſe being the ſame in all theſe,
" excepting that, where the thickneſs of the plate is not regular, the rings will not
" be ſo; that in plates of denſer tranſparent bodies, the rings are made at a leſs
" thickneſs of the plate (the vibrations, I ſuppoſe, being ſhorter in rarer æther than
" in denſer) and that in a denſer plate, ſurrounded with a rarer body, the colours
" are more vivid than in the rarer ſurrounded with the denſer; as, for inſtance,
" more vivid in a plate of glaſs ſurrounded with air, than in a plate of air ſur-
" rounded with glaſs; of which the reaſon is, that the reflection of the ſecond ſu-
" perficies, which cauſes the colours, is, as was ſaid above, ſtronger in the for-

[a] Obſ. 24.

 " mer

"mer case than in the latter: for which reason also the colours are most vivid, "when the difference of the density of the medium is greatest.

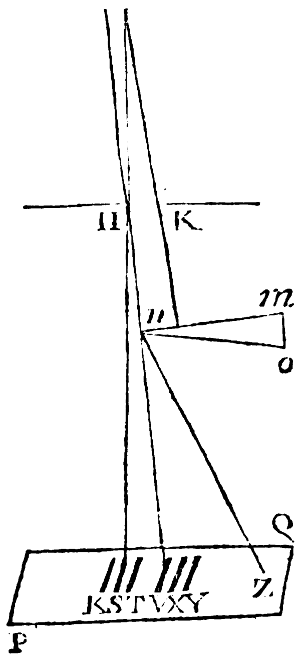
"Of the colours of natural bodies also I have said enough in those papers, shew-"ing how the various sizes of the transparent particles, of which they consist, is "sufficient to produce them all, those particles reflecting or transmitting this or "that sort of rays, according to their thickness, like the aforesaid plates, as if they "were fragments thereof. For, I suppose, if a plate of an even thickness, and "consequently of an uniform colour, were broken into fragments of the same thick-"ness with the plate, a heap of those fragments would be a powder much of the "same colour with the plates. And so, if the parts be of the thickness of the "water in the black spot at the top of a bubble described in the seventeenth of "the observations I send you, I suppose the body must be black. In the pro-"duction of which blackness, I suppose, that the particles of that size being dis-"posed to reflect almost no light outward, but to refract it continually in its pas-"sage from every part to the next; by this multitude of refractions, the rays "are kept so long straggling to and fro within the body, till at last almost all "impinge on the solid parts of the body, and so are stopped and stifled; those "parts having no sufficient elasticity, or other disposition to return nimbly enough "the smart shock of the ray back upon it.

"I should here conclude, but that there is another strange phænomenon of "colours, which may deserve to be taken notice of. Mr. Hooke, you may re-"member, was speaking of an odd straying of light, caused in its passage near the "edge of a razor, knife, or other opake body in a dark room; the rays, which "pass very near the edge, being thereby made to stray at all angles into the "shadow of the knife.

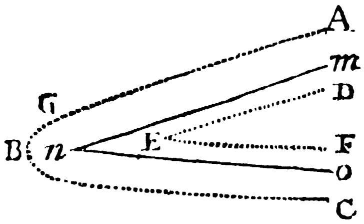
"To this Sir William Petty, then president, returned a very pertinent query, "Whether that straying was in curve lines? and that made me, having heard "Mr. Hooke some days before compare it to the straying of sound into the qui-"escent medium, say, that I took it to be only a new kind of refraction, caused "perhaps by the external æther's beginning to grow rarer a little before it "came at the opake body, than it was in free spaces; the denser æther without "the body, and the rarer within it, being terminated not in a mathematical "superficies, but passing into one another through all intermediate degrees of "density: whence the rays, that pass so near the body, as to come within that "compass, where the outward æther begins to grow rarer, must be refracted by "the uneven denseness thereof, and blended inwards toward the rarer medium of "the body. To this Mr. Hooke was then pleased to answer, that though it "should be but a new kind of refraction, yet it was a new one. What to make "of this unexpected reply, I knew not; having no other thoughts, but that a "new kind of refraction might be as noble an invention as any thing else about "light; but it made me afterwards, I know not upon what occasion, happen to "say, among some that were present to what passed before, that I thought I had "seen the experiment before in some Italian author. And the author is Hono-"ratus Faber, in his dialogue De Lumine, who had it from Grimaldo;

"whom

" whom I mention, because I am to describe something further out of him, which " you will apprehend by this figure : suppose the sun shine through the little hole " H K into a dark room upon the paper P Q, and with a wedge M N O intercept " all but a little of that beam, and you will see " upon the paper six rows of colours, R, S, T, " V, X, Y, and beyond them a very faint light " spreading either way, such as rays broken, like " H N Z, must make. The author describes it " more largely in divers schemes. I have time " only to hint the sum of what he says.



" Now for the breaking of the ray H N Z, sup- " pose, in the next figure M N O be the solid " wedge, A B C the inward bound of the uniform " rarer æther within, between which bounds the " æther runs through all the intermediate degrees ; " and it is manifest, that, if a ray come between " B and N, it must in its passage there bend from " the denser medium towards C, and that so much " the more, by how much it comes nearer N. Fur- " ther, for the three rows of colours V X Y, those " may perhaps proceed from the number of vibra- " tions (whether one, two, or three) which over- " take the ray in its passage from G, till it be about " the mid-way between G and H ; that is, at its " nearest distance to N, so as to touch the circle " described about N, with that distance ; by the " last of which vibrations, expanding or con- " tracting the medium there, the ray is licensed " to recede again from N, and go on to make the " colours ; or further bent about N, till the inter- " val of the next wave overtake it, and give it li- " berty to go from N, very nearly in the line it is " then moving, suppose toward Z, to cause the faint light spoken of above, you " will understand me a little better, by comparing this with what was said of the " colours of thin transparent plates, comparing the greatest distance that the ray " goes from G B H towards N, to the thickness of one of those plates. Some- " thing too there is in Des Cartes's explication of the rainbow's colours, which " would give further light in this. But I have no time left to insist further upon " particulars ; nor do I propound this without diffidence, having not made suffici- " ent observation about it."



After reading this discourse, Mr. Hooke said, that the main of it was contained in his *Micrographia*, which Mr. Newton had only carried farther in some particulars.

The Society adjourned till December 30.

Decem-

December 30. There was read a letter to Mr. OLDENBURG from Mr. NEWTON, dated at Cambridge 21ſt December, 1675 [1], in anſwer to what had been written to him by Mr. OLDENBURG concerning the want of ſucceſs of his experiment made with a glaſs rubbed, &c. This letter was as follows:

"Upon your letter I took another glaſs four inches broad, and one fourth of "an inch thick, of ſuch glaſs as teleſcopes are made of, and placed it a one ſixth "part of an inch from the table. It was ſet in ſuch a piece of wood, as the ob-"ject-glaſſes of teleſcopes uſe to be ſet in: and the experiment ſucceeded well. "After the rubbing was ſtill, and all was ſtill, the motion of the papers would "continue ſometimes while I counted a hundred, every paper leaping up about "twenty times more or leſs, and down as often. I tried it alſo with two other glaſſes "that belong to a teleſcope, and it ſucceeded with both; and I make no queſtion "but any glaſs will do that, if it be excited to electric virtue, as I think any may. "If you have a mind to any of theſe glaſſes, you may have them; but I ſup-"poſe, if you cannot make it do in other glaſs, you will fail in any I can ſend "you. I am apt to ſuſpect the failure was in the manner of rubbing; for I have "obſerved, that the rubbing variouſly, or with various things, alters the caſe. At "one time I rubbed the aforeſaid great glaſs with a napkin, twice as much as I "uſed to do with my gown, and nothing would ſtir; and yet preſently rubbing "it with ſomething elſe, the motions ſoon began. After the glaſs has been "much rubbed too, the motions are not ſo laſting; and the next day I found the "motions fainter and difficulter to excite than the firſt. If the Society have a "mind to attempt it any more, I can give no better advice than this: to take a "new glaſs not yet rubbed (perhaps one of the old ones may do well enough after "it has lain ſtill a while) and let this be rubbed, not with linen, nor ſoft nappy "woolen, but with ſtuff, whoſe threads may rake the ſurface of the glaſs, ſup-"poſe tamerine, or the like, doubled up in the hand, and this with a briſk mo-"tion as may be, till an hundred or an hundred and fifty may be counted, the "glaſs lying all the while over the papers. Then, if nothing ſtir, rub the glaſs "with the finger ends half a ſcore of times to and fro, or knock your finger-"ends as often upon the glaſs; for this rubbing or knocking with your fingers, "after the former rubbing, conduces moſt to excite the papers. If nothing ſtir "yet, rub again with the cloth till ſixty or eighty may be counted, and then "rub or knock again with your fingers, and repeat this till the electric virtue of "the glaſs be ſo far excited as to take up the papers, and then a very little rubb-"ing or knocking now and then will revive the motions. In doing all this, let "the rubbing be always done as nimbly as may be; and if the motion be circu-"lars, like that of glaſs-grinding, it may do better. But if you cannot make it "yet ſucceed, it muſt be let alone till I have ſome opportunity of trying it be-"fore you. As for the ſuſpicion of the papers being moved by the air, I am ſe-"cure from that; yet in the other, of drawing leaf-gold to above a foot diſtance, "which I never went about to try myſelf till the laſt week, I ſuſpect the air might "raiſe the gold, and then a ſmall attraction might determine it towards the glaſs; "for I could not make it ſucceed."

[1] Letter-book, vol. vii. p. 284.

It

It was ordered, that Mr. NEWTON's directions in this letter should be observed in the experiment to be made at the next meeting of the Society.

Mr. OLDENBURG read a letter to himself from Mr. JOHN GASCOIGNE, dated at Liege, 15th December, 1675 [u], acquainting him with the death of Mr. LINUS of the epidemical disease, which then raged through so many countries, and with the resolution of Mr. LINUS's disciples, to try Mr. NEWTON's experiment concerning light and colours more clearly and carefully, and before more witnesses, according to the directions given them by Mr. NEWTON's last letter: intimating withal, that if the said experiment be made before the Royal Society, and be attested by them to succeed, as Mr. NEWTON affirmed, they would rest satisfied.

It was ordered, that when the sun should serve, the experiment should be made before the Society.

Mr. AUBREY presented the Society with his observations made in Wiltshire, which being read, he was desired to endeavour to procure some of the iron-ore of Sein in that county, said to be so rich, that the smith could melt it in his forge: as also to procure from Easton-Peires in Malmesbury hundred, some of the blue clay, free from sand, and almost of the colour of ultramarine; which clay Mr. DOIGHT supposed to be very fit for porcelane.

The Society adjourned till the 13th of January following.

January 13. Captain HENRY SHEERES, JOHN MAPLETOFT, M. D. [x], and Signor FRANCISCO TRAVAGINI were proposed candidates, the first in the name of Sir JOSEPH WILLIAMSON, the second by Mr. HOOKE, and the third by Mr. OLDENBURG.

Mr. NEWTON's experiment of glass rubbed, to cause various motions in bits of paper underneath, being made according to his more particular directions, succeeded very well. The rubbing was made both with a scrubbing brush, made of short hog's bristles, with a knife, the haft of the knife made of whalebone, and with the nail of one's finger. It appeared, that touching many parts at once with a hard and rough body, produced the effect expected.

It was ordered, that Mr. NEWTON should have the thanks of the Society, for giving himself the trouble of imparting to them such full instructions for making the experiment.

Mr. OLDENBURG produced and read a Latin letter of Mr. FLAMSTEAD to Sir JONAS MOORE, dated at Greenwich, 24th December, 1675 [y], containing an account of his observations made of the late eclipse of the moon on the 21st December, *p. m.*

[u] Letter-book, vol. vii. p. 282.

[x] Professor of physic at Gresham College.

[y] It is printed in the Philosoph. Transact. vol. x. n° 121. p. 495.

It

It was ordered, that Mr. OLDENBURG should be desired, according to the motion made by Mr. FLAMSTEAD, to impart these observations to Signor CASSINI at Paris, and to desire him to communicate to the Society his observations on the same eclipse.

Mr. OLDENBURG produced likewise some papers of Mr. AUBREY, containing his observations of the county of Surry. But the time being elapsed, these papers were referred to the next meeting.

January 20. Mr. AUBREY's papers of observations on Surrey were read.

There was also read the beginning of Mr. NEWTON's discourse, containing such observations, as conduce to further discoveries for completing his theory of light and colours, especially as to the constitution of natural bodies, on which their colours or transparency depend: in which he describes first the principal of his observations, and then considers and makes use of them.

At this time there were read the first fifteen of those observations as follow [z]:

" I suppose you understand, that all transparent substances (as glass, water, " air, &c.) when made very thin by being blown into bubbles, or otherwise " formed into plates, do exhibit various colours, according to their various thin- " ness, although at a greater thickness they appear very clear and colourless. In " my former discourse about the constitution of light, I omitted these colours, " because they seemed of a more difficult consideration, and were not necessary for " the establishing of the doctrine, which I propounded; but because they may con- " duce to further discoveries for compleating that theory, especially as to the " constitution of the parts of natural bodies, on which their colours or transpa- " rency depend, I have now sent you an account of them. To render this dis- " course short and distinct, I have first described the principal of my observations, " and then considered and made use of them. The observations are these:

" Obs. 1. Compressing two prisms hard together, that their sides (which by " chance were a very little convex) might somewhere touch one another, I found " the place, in which they touched, to become [a] absolutely transparent, as if they " had been there one continued piece of glass; for when the light fell so ob- " liquely on the air, which in other places was between them, as to be all re- " flected, in that place of contact it seemed wholly transmitted; insomuch that " when looked upon, it appeared like a black or dark spot, by reason of no sen- " sible light was reflected from thence, as from other places; and when looked " through, it seemed, as it were, a hole in that air, that was formed into a thin

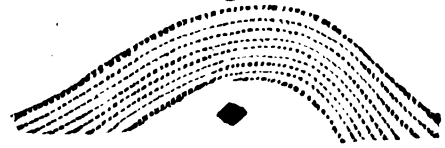
[z] Register, vol. v. p. 89.

[a] " Note, that there is some light reflected from " those parts of this black spot, where the glasses, " by reason of their convexity, and some little un- " evenness of their surfaces, do not come to abso- " lute contact. For by viewing the sun, by re- " flection from this spot, not only the verges of " it became lucid, but divers lucid veins, as specks, " appeared in the midst of the blackness: but yet " some parts of the spot seemed still as black as " before, which parts I take to be those, where " the glasses touched.

" plate by being compreſſed between the glaſſes; and through this hole objects, " that were beyond, might be ſeen diſtinctly, which could not at all be ſeen through " other parts of the glaſſes, where the air was interjacent. Although the glaſſes " were a little convex, yet this tranſparent ſpot was of a conſiderable breadth, " which breadth ſeemed principally to proceed from the yielding inwards of the " parts of the glaſſes by reaſon of their mutual preſſure; for by preſſing them very " hard together, it would become much broader than otherwiſe.

" Obſ. 2. When the plate of air, by turning the priſms about their common " axis, became ſo little inclined to the incident rays, that ſome of them began to " be tranſmitted, there aroſe in it many ſlen- " der arcs of colours, which at firſt were " ſhaped almoſt like the conchoid, as you ſee " them here delineated. And by continuing " the motion of the priſms, theſe arcs in- " creaſed and bended more and more about " the ſaid tranſparent ſpot, till they were " compleated into circles or rings incompaſſing it, and afterwards continually " grew more and more contracted.

Fig. I.



" Theſe arcs, at their firſt appearance, were of a violet and blue colour, and " between them were white arcs of circles, which preſently became a little tinged " in their inward limbs with red and yellow, and to their outward limbs the blue " was adjacent; ſo that the order of theſe colours from the central dark ſpot, " was at that time white, blue, violet, black, red, orange, yellow, white, blue, " violet, &c. but the yellow and red were much fainter than the blue and vio- " let.

" The motion of the priſms about their axis being continued, theſe colours " contracted more and more, ſhrinking towards the whiteneſs on either ſide of " it, until they totally vaniſhed into it; and then the circles in thoſe parts ap- " peared black, and white, without any other colours intermixed; but by fur- " ther moving the priſms about, the colours again emerged out of the whiteneſs, " the violet and blue at its inward limb, and at its outward limb the red and yel- " low; ſo that now their order from the central ſpot was white, yellow, red, " black, violet, blue, white, yellow, red, &c. contrary to what it was before.

" Obſ. 3. When the rings or ſome parts appeared only black and white, they " were very diſtinct and well defined, and the blackneſs ſeemed as intenſe as that " of the central ſpot; alſo, in the borders of theſe rings, where the colours began " to emerge out of the whiteneſs, they were pretty diſtinct, which made them vi- " ſible to a very great multitude. I have ſometimes numbered above thirty ſuc- " ceſſions (reckoning every black and white ring for one ſucceſſion) and ſeen more " of them, which by reaſon of their ſmallneſs I could not number. But in other " poſitions of the priſms, at which the rings appeared of many colours, I could " not diſtinguiſh above eight or nine of them, and the exterior of thoſe too " were confuſed and dilute.

" In these two observations, to see the rings distinct, and without any other colour " but black and white, I found it necessary that I held my eye at a good distance " from them. For by approaching nearer, although in the same inclination of " my eye, yet there emerged a bluish colour out of the white, which by dilating " itself more and more into the black, rendered the circles less distinct, and left " the white a little tinged with red and yellow. I found also, that by looking " through a slit or oblong hole, which was narrower than the pupil of my eye, " and held close to it parallel to the prisms, I could see the circles much distincter " and visible to a far greater number than otherwise.

" Obs. 4. To observe more nicely the order of the colours, which arose out of " the white circles, as the rays became less and less inclined to the plate of air; I " took two object-glasses, the one a plane-convex for a fourteen foot telescope, " and the other a large double convex for one of fifty foot; and upon this lay- " ing the other with its plane side downwards, I pressed them slowly together, " to make the colours successively emerge in the middle of the circles, and then " slowly lifted the upper glass from the lower, to make them successively vanish " again in the same place, where being of a considerable breadth, I could more " easily discern them. And by this means I observed their succession and quan- " tity to be as followeth.

" Next to the pellucid central spot made by the contact of the glasses, suc- " ceeded violet, blue, white, yellow, and red. The violet and blue were so very " little in quantity, that I could not discern them in the circles made by the " prisms; but the yellow and red were pretty copious, and seemed about as much " in extent as the white, and four or five times more than the blue and violet. " The next circuit or order of colours immediately encompassing these was vio- " let, blue, green, yellow, and red. And these were all of them copious and " vivid, excepting the green, which was very little in quantity, and seemed much " more faint and dilute than the other colours. Of the other four the violet " was least, and the blue less than the yellow or red. The third circuit or order " was also purple, blue, green, yellow, and red, in which the purple seemed more " reddish than the violet in the former circuit, and the green was much more " conspicuous, being as brisk and copious as any of the other colours except the " yellow; but the red began to be a little faded, inclining very much to purple. " After these succeeded green and red: the green was very copious and lively, in- " clining on the one side to blue, and the other to yellow. But in this fourth " circuit there was neither violet, blue, nor yellow, and the red was very imper- " fect and dirty. Also the succeeding colours became more and more imperfect " and dilute, till after three or four more revolutions they ended in perfect white- " ness.

" Obs. 5. To determine the interval of the glasses, or thickness of the interja- " cent air, by which each colour was produced; I measured the diameter of the " first six rings at the most lucid part of their orbits, and squaring them I found " their squares to be in arithmetical progression of the odd numbers, 1. 3. 5. 7. " 9. 11. And since one of the glasses was plane and the other spherical, their

" intervals at those rings must be in the same progression. I measured also the " diameters of the dark or faint rings between the more lucid colours, and found " their squares to be in arithmetical progression, of the even numbers 2, 4, 6, " 8, 10, 12; and it being very nice and difficult to take these measures exactly, " I repeated them divers times, at divers parts of the glasses, that by their agree- " ment I might be confirmed in them; and the same method I used in deter- " mining some others of the following observations.

" Obs. 6. The diameter of the first ring, at the most lucid part of its orbit, " was $\frac{58}{100}$ parts of an inch, and the diameter of the sphere, on which the double " convex object-glass was ground, was an hundred and two foot, as I found by " measuring it; and consequently the thickness of the air, or aereal interval of the " glasses at that ring, was $\frac{1}{14554}$ of an inch. For as the diameter of the said sphere " (an hundred and two foot, or twelve hundred and twenty-four inches) is to " the semidiameter of the ring $\frac{29}{100}$, so very nearly is that semidiameter to $\frac{1}{14554}$, " the said distance of the glasses. Now, by the precedent observations, the " eleventh part of this distance ($\frac{1}{160094}$) is the thickness of the air at that part " of the first ring, where the yellow would be most vivid, were it not mixed " with other colours in the white; and this doubled gives the difference of its " thickness at the yellow in all the other rings, viz. $\frac{1}{80047}$, or, to use a round " number, the eighty thousand part of an inch.

" Obs. 7. These dimensions were taken, when my eye was placed perpendicu- " larly over the glasses, in or near the axis of the rings; but when I viewed " them obliquely, they became bigger, continually swelling as I removed my eye " farther from their axis; and partly by measuring the diameter of the same " circle at several obliquities of my eye, partly by other means; as also by mak- " ing use of the two prisms for very great obliquities, I found its diameter, and " consequently the thickness of the air at its perimeter in all those obliquities, to " be very nearly in the proportions expressed in this table.

Incidence on the air.		Refraction into the air.		Diameter of the ring.	Thickness of the air.
gr.	min.	gr.	min.		
00	00	00	00	10	10
6	26	10	00	$10\frac{1}{13}$	$10\frac{2}{13}$
12	45	20	00	$10\frac{1}{3}$	$10\frac{2}{3}$
18	49	30	00	$10\frac{3}{4}$	$11\frac{1}{2}$
24	30	40	00	$11\frac{2}{5}$	13
29	37	50	00	$12\frac{1}{2}$	$15\frac{1}{2}$
33	58	60	00	14	20
35	47	65	00	$15\frac{1}{4}$	$23\frac{1}{3}$
37	19	70	00	$16\frac{4}{5}$	$28\frac{1}{2}$
38	33	75	00	$19\frac{1}{4}$	37
39	27	80	00	$22\frac{6}{7}$	$52\frac{1}{4}$
40	00	85	00	29	84
40	11	90	00	35	$122\frac{1}{2}$

In

"In the two first columns are expressed the obliquities of the rays to the plate "of air; that is, their angles of incidence and refraction. In the third column, "the diameter of any coloured ring of those obliquities is expressed in parts, of "which ten constitute that diameter, when the rays are perpendicular. And in "the fourth column the thickness of the air at the circumference of that ring is "expressed in parts, of which also ten constitute that thickness, when the rays "are perpendicular.

"Obs. 8. The dark spot in the middle of the rings increased also by that "obliquation of the eye, although almost insensibly. But, if instead of the "object-glasses, the prisms were made use of, its increase was more manifest, when "viewed so obliquely, that no colours appeared about it. It was least, when the "rays were incident most obliquely on the interjacent air, and increased more and "more, until the coloured rings appeared, and then decreased again, but not so "much as it increased before. And hence it is evident, that the transparency "was not only at the absolute contact of the glasses, but also where they had some "little interval. I have sometimes observed the diameter of that spot to be be-"tween half and two fifth parts of the diameter of the exterior circumference of "the red in the first circuit or revolution of colours, when viewed almost per-"pendicularly; whereas, when viewed obliquely, it hath wholly vanished, and "become opake and white, like the other parts of the glass. Whence it may "be collected, that the glasses did then scarcely, or not at all, touch one ano-"ther; and that their interval of the perimeter] of that spot, when viewed per-"pendicularly, was about a fifth or sixth part of their interval at the circum-"ference of the said red.

"Obs. 9. By looking through the two contiguous object-glasses, I found, that "the interjacent air exhibited rings of colours, as well by transmitting light as "by reflecting it. The central spot was now white, and from it the order of "the colours were yellowish, red, black, violet, blue, white, yellow, red; "violet, blue, green, yellow, red, &c. but these colours were very faint and "dilute, unless when the light was trajected very obliquely through the glasses; "for by that means they became pretty vivid, only the first yellowish red, like "the blue in the fourth observation, was so little and faint as scarcely to be dis-"cerned. Comparing the coloured rings made by reflection with these made by "transmission of the light, I found, that white was opposite to black, red to blue, "yellow to violet, and green to a compound of red and violet; that is, those "parts of the glass were black when looked through, which when looked upon "appeared white, and on the contrary; and so those, which in one case exhibited "blue, did in the other case exhibit red; and the like of the other colours.

"Obs. 10. Wetting the object-glass a little at their edges, the water crept in "slowly between them, and the circles thereby became less, and the colours "more faint; insomuch that, as the water crept along, one half of them, at which "it first arrived, would appear broken off from the other half, and contracted "into a less room. By measuring them I found the proportion of their diameters "to the diameters of the like circles made by air, to be about seven to eight; "and

" and consequently the intervals of the glasses at like circles, caused by these two " mediums, water and air, are as about three to four. Perhaps it may be a general " rule, that if any other medium, more or less dense than water, be compressed " between the glasses, their interval at the rings, caused thereby, will be to their " interval, caused by interjacent air, as the sines are, which measure the refrac- " tion made out of that medium into air.

" Obs. 11. When the water was between the glasses, if I pressed the upper " glass variously at its edges to make the rings move nimbly from one place to " another, a little bright spot would immediately follow the center of them, " which, upon creeping in of the ambient water into that place, would presently " vanish. Its appearance was such, as interjacent air would have caused, and it " exhibited the same colours; but it was not air, for where any aereal bubbles " were in the water they would not vanish. The reflection must rather have been " caused by a subtiler medium, which could recede through the glass at the " creeping in of the water.

" Obs. 12. These observations were made in the open air. But further, to " examine the effects of coloured light falling on the glasses, I darkened the " room, and viewed them by reflection of the colours of a prism cast on a sheet " of white paper; and by this means the rings became distincter, and visible to " a far greater number than in the open air.

" I have seen more than twenty of them, whereas in the open air I could not " discern above eight or nine.

" Obs. 13. Appointing an assistant to move the prism to and fro about its " axis, that all its colours might successively fall on the same place of the paper, " and be reflected from the circles to my eye whilst I held it immoveable; I " found the circles, which the red light made, to be manifestly bigger than " those, which were made by the blue and violet; and it was very pleasant to see " them gradually swell or contract, accordingly as the colour of the light was " changed. The interval of the glass at any of the rings, when they were made " by the utmost red light, was to their interval at the same ring, when made " by the utmost violet, greater than three to two, and less than thirteen to eight. " By the most of my observations it was as nine to fourteen. And this pro- " portion seemed very nearly the same in all obliquities of my eye, unless when " two prisms were made use of instead of the object-glasses: for then, at a " certain great obliquity, the rings made by the several colours seemed equal; " and, at a greater obliquity, those made by the violet would be greater than the " same rings made by the red.

" Obs. 14. While the prism was turned about uniformly, the contraction or " dilatation of a ring made by all the several colours of the prism successively " reflected from the object-glasses, was swiftest in the red, slowest in the violet, " and in intermediate colours it had intermediate degrees of celerity. Comparing " the extent, which each colour obtained by this contraction or dilatation, I found,

 " that

"that the blue was sensibly more extended than the violet, the yellow than the "blue, and the red than the yellow. And, to make a juster estimation of their "proportions, I observed, that the extent of the red was almost double to that "of the violet, and that the light was of a middle colour between yellow and "green at that interval of the glasses, which was an arithmetical mean between "the two extremes; contrary to what happens in the colours made by the re-"fraction of a prism, where the red is most contracted, the violet most expanded, "and in the midst of them is the confine of green and blue.

"Obs. 15. These rings were not of various colours, like those in the open "air, but appeared all over of that prismatic colour only, with which they were "illuminated: and, by projecting the prismatic colours immediately upon the "glasses, I found, that the light, which fell on the dark spaces, which were be-"tween the coloured rings, was transmitted through the glasses without any va-"riation of colour. For, on a white paper placed behind, it would paint rings "of the same colour with those, which were reflected, and of the bigness of their "intermediate spaces. And from hence the origin of these rings is manifest, "namely, that the aereal interval of the glasses, according to its various thick-"ness, is disposed in some places to reflect, and in others to transmit, the light "of any colour; and, in the same place to reflect one colour, where it transmits "another.

These observations so well pleased the Society, that they ordered Mr. Oldenburg to desire Mr. Newton to permit them to be published, together with the rest; which, they presumed, did correspond with those, that had been now read to them.

Besides, there was read a passage of Mr. Newton's letter to Mr. Oldenburg, of 21 December, 1675, stating the difference between his hypothesis and that of Mr. Hooke. Which passage was as follows:

"As for Mr. Hooke's insinuation, that the sum of the hypothesis I sent you "had been delivered by him in his Micrography, I need not be much concerned "at the liberty he takes in that kind: yet, because you think it may do well, "if I state the difference I take to be between them, I shall do it as briefly as I "can, and that the rather, that I may avoid the favour of having done any "thing unjustifiable or unhandsome towards Mr. Hooke. But, for this end, I "must first (to see what is his) cast out what he has borrowed from Des Car-"tes, or others, viz. that there is an æthereal medium; that light is the action "of this medium; that this medium is less implicated in the parts of solid "bodies, and so moves more freely in them, and transmits light more readily "through them, and that after such a manner, as to accelerate the rays in a cer-"tain proportion; that refraction arises from this acceleration, and has sines "proportional; that light is at first uniform; that its colours are some distur-"bance or new modification of its rays by refraction or reflection; that the co-"lours of a prism are made by means of the quiescent medium, accelerating "some motion of the rays on one side, where red appears, and retarding it on "the

" the other side, where blue appears; and, that there are but these two original " colours, or colour-making modifications of light, which by their various degrees, or, as Mr. HOOKE calls it, dilutings, produce all intermediate ones. " This rejected, the remainder of his hypothesis is, that he has changed DES " CARTES's pressing or progressive motion of the medium to a vibrating one, the " rotation of the globuli to the obligation of pulses, and the accelerating their " rotation on the one hand, and retarding it on the other, by the quiescent medium, to produce colours, to the like action of the medium on the two ends of " his pulses for the same end. And having thus far modified his by the Cartesian hypothesis, he has extended it further, to explicate the phænomena of thin " plates, and added another explication of the colours of natural bodies, fluid " and solid.

" This, I think, is in short the sum of his hypothesis; and in all this I have " nothing common with him, but the supposition, that æther is a susceptible medium of vibrations, of which supposition I make a very different use; " he supposing it a light itself, which I suppose it is not. This is as great a difference as is between him and DES CARTES. But besides this, the manner of " refraction and reflection, and the nature and production of colours in all cases " (which takes up the body of my discourse) I explain very differently from " him; and even in the colours of thin transparent substances, I explain every " thing after a way so differing from him, that the experiments I ground my " discourse on, destroy all he has said about them; and the two main experiments, without which the manner of the production of those colours is not to " be found out, were not only unknown to him, when he wrote his Micrography, but even last spring, as I understood, in mentioning them to him. This " therefore is the sum of what is common to us, that æther may vibrate; and " so, if he thinks fit to use that notion of colours, arising from the various bigness of pulses (without which his hypothesis will do nothing) *his* will borrow " as much from my answer to his objections, as that I send you does from his " Micrography.

" But, it may be, he means, that I have made use of his observations, and of " some I did; as, that of the inflection of rays, for which I quoted him; that " of opacity, arising from the interstices of the parts of bodies, which I insist " not on; and that of plated bodies exhibiting colours, a phænomenon, for the " notice of which I thank him. But he left me to find out and make such experiments about it, as might inform me of the manner of the production of those " colours, to ground an hypothesis on; he having given no further insight to it " than this, that the colour depended on some certain thickness of the plate; " though what that thickness was at every colour, he confesses in his Micrography, he had attempted in vain to learn; and therefore, seeing I was left to " measure it myself, I suppose he will allow me to make use of what I took " the pains to find out. And this I hope may vindicate me from what Mr. " HOOKE has been pleased to charge me with."

The reading of the rest of Mr. NEWTON's discourse was referred to the next meeting.

January

January 27. Mr. OLDENBURG produced from his highness prince RUPERT a piece of marble, having several pictures of boys and trees painted upon it in such a manner, that all the out-lines of the pictures were exactly defined without any flowing of the colours abroad, and the colours fixed by the fire, and afterwards so polished, that they would be permanent, and last as long as the marble.

This was acknowledged by the members to be a very great improvement of what had been done at Oxford by a certain stone-cutter there; and that all, that had been performed before in this art, was not comparable to this degree of improvement.

Mr. HOOKE remarked, that he conceived, that there were but two colours in this piece; and that he had a method of doing it with most colours, and to paint with them upon marble almost as curiously as with a pencil.

Mr. NEWTON's letter of January 25, $167\frac{5}{6}$ [c], in which he acknowledged the favour of the Society in their kind acceptance of his late papers; and declared, that he knew not how to deny any thing, which they desired should be done: but he requested, that the printing of his observations about colours might be suspended for a time, because he had some thoughts of writing such another set of observations for determining the manner of the production of colours by the prism: which observations, he said, ought to precede those now in the Society's possession, and would be most proper to be joined with them.

There was also read a letter of Mr. PASCALL of Somersetshire to Mr. AUBREY, dated 18 January, $167\frac{5}{6}$, containing some natural observations of that county, viz. concerning the nature of the lead-mines in Mendip-Hills; a well resembling the sulphur-well near the Spaw in Yorkshire; a spring petrifying far more than the dropping-well at Knaresborough in the north; the motion of some underground waters in the parishes of Zoylande, formerly recovered from the sea, &c.

It was ordered, that the reading of Mr. NEWTON's observations about colours be continued at the next meeting.

February 3. There was presented from Dr. WALLIS his edition of ARCHIMEDES's *Arenarius*, with a new translation of his and notes, printed at Oxford, in 1676.

The reading of Mr. NEWTON's observations on colours was continued, viz. that part, wherein he explains by the simplest of colours the more compounded; as follows:

"Obs. 16. The squares of the diameters of these rings, made by prismatic
" colour, were in arithmetical progression, as in the fifth observation. And the
" diameter of the sixth circle, when made by the yellow, and viewed almost perpendicularly, was obout $\frac{58}{100}$ parts of an inch, agreeable to the sixth obser-
" vation.

[c] There are no letters entered from the beginning of the year $167\frac{5}{6}$ till July 1677.

" perpen-

" The precedent obſervations were made with a rarer thin medium terminated " by a denſer, ſuch as was air or water compreſſed betwixt two glaſſes. In " thoſe, that follow, are ſet down the appearances of a denſer medium thinned " within a rarer; ſuch as are plates of Muſcovy-glaſs, bubbles of water, and " ſome others thin ſuſtances terminated on all ſides with air.

" Obſ. 17. If a bubble be blown with water, firſt made tenacious by diſſolv- " ing a little ſoap in it, it is a common obſervation, that after a while it will " appear tinged with a great variety of colours. To defend theſe bubbles from " being agitated by the external air (whereby their colours are irregularly moved " one among another, ſo that no accurate obſervation can be made of them) as " ſoon as I had blown any of them, I covered it with a clear glaſs, and by that " means its colours emerged in a very regular order, like ſo many concentric " rings incompaſſing the top of the bubble. And as the bubble grew thinner " by the continual ſubſiding of the water, theſe rings dilated ſlowly, and over- " ſpread the whole bubble, deſcending in order to the bottom of it, where they " vaniſhed ſucceſſively. In the mean while, after all the colours were emerged " at the top, there grew in the center of the rings a ſmall, round, black ſpot, " like that in the firſt obſervation, which continually dilated itſelf, till it became " ſometimes more than one half or three fourths of an inch in breadth, before the " bubble broke. At firſt I thought there had been no light reflected from the water " in that place; but obſerving it more curiouſly, I ſaw within it ſeveral ſmaller, " round ſpots, which appeared much blacker and darker than the reſt, whereby " I knew, that there was ſome reflection at the other places, which were not ſo " dark as thoſe ſpots. And by further trial I found, that I could ſee the images " (as of a candle or the ſun) very faintly reflected, not only from the great black " ſpot, but alſo from the little darker ſpots, which were within it.

" Beſides the aforeſaid coloured rings, there would often appear ſmall ſpots of " colours aſcending and deſcending up and down the ſide of the bubble, by rea- " ſon of ſome inequalities in the ſubſiding of the water; and ſometimes ſmall black " ſpots generated at the ſides, would aſcend up to the larger black ſpot at the " top of the bubble, and unite with it.

" Obſ. 18. Becauſe the colours of theſe bubbles were more extended and " lively than thoſe of air thinned between two glaſſes, and ſo more eaſy to be " diſtinguiſhed, I ſhall here give you a further deſcription of their order, as they " were obſerved in viewing them by reflection of the ſkies, when of a white " colour, whilſt a black ſubſtance was placed behind the bubble: and they were " theſe; red, blue, red, blue; red, blue; red, green; red, yellow; green, blue, " purple; red, yellow, green, blue, violet; red, yellow, white, blue, black.

" The three firſt ſucceſſions of red and blue were very dilute and dirty, eſpe- " cially the firſt, where the red ſeemed in a manner to be white. Amongſt theſe " there was ſcarcely any other colour ſenſible, only the blues (and principally the " ſecond blue) inclined a little to green.

" The fourth red was alſo dilute and dirty, but not ſo much as the former " three: after that ſucceeded little or no yellow, but a copious green, which at " firſt was inclined a little to yellow, and then became a pretty briſk and good " willow green, and afterwards changed to a blueiſh colour; but there ſucceded " neither blue nor violet.

" The fifth red at firſt was very much inclined to purple, and afterwards be-" came more bright and briſk, but yet not very pure. This was ſucceeded with " a very bright and intenſe yellow, which was but little in quantity, and ſoon " changed to green; but that green was copious, and ſomething more pure, " deep, and lively, than the former green. After that followed an excellent blue " of a bright ſky colour; and then a purple, which was leſs in quantity than the " blue, and much inclined to red.

" The ſixth red was at firſt of a very fair and lively ſcarlet, and ſoon after " of a brighter colour, being very pure and briſk, and the beſt of all the reds. " Then, after a lively orange, followed an intenſe, bright, and copious yellow, " which was alſo the beſt of all the yellows; and this changed, firſt to a greeniſh " yellow, and then to a greeniſh blue; but the green between the yellow and " blue was very little and dilute, ſeeming rather a greeniſh white than a green. " The blue, which ſucceeded, became very good, and of a fair, bright, ſky-colour; " but yet ſomething inferior to the former blue: and the violet was intenſe and " deep, with little or no redneſs in it, and leſs in quantity than the blue.

" In the laſt red appeared a tincture of ſcarlet next the violet, which ſoon " changed to a brighter colour, inclining to an orange: and the yellow, which " followed, was at firſt pretty good and lively, but afterwards it grew more and " more dilute, until by degrees it ended in perfect whiteneſs: and this whiteneſs, " if the water was very tenacious and well tempered, would ſlowly ſpread and " dilate itſelf over the greateſt part of the bubble, continually growing paler at " the top, where at length it would crack, and thoſe cracks, as they dilated, " would appear of a pretty good, but yet obſcure and dark, ſky-colour; the " white between the blue ſpots diminiſhing, until it reſembled the threads of an " irregular net-work, and ſoon after vaniſhed and left all the upper part of the " bubble of the ſaid dark blue colour; and this colour, after the aforeſaid man-" ner, dilated itſelf downwards, until ſometimes it hath overſpread the whole " bubble. In the mean while, at the top, which was of a darker blue than the " bottom, and appeared alſo of many round blue ſpots, ſomething darker than " the reſt, there would emerge one or more very black ſpots, and within thoſe, " other ſpots of an intenſer blackneſs, which I mentioned in the former obſerva-" tion; and thoſe continually dilated themſelves until the bubble broke.

" If the water was not very tenacious, the black ſpots would break forth in " the white, without any ſenſible intervention of the blue: and ſometimes they " would break forth within the precedent yellow, or red, or perhaps within " the blue of the ſecond order, before the intermediate colours had time to diſ-" play themſelves.

" By

" By this description you may perceive, how great an affinity these colours " have with those of air, described in the fourth observation, although set down " in a contrary order, by reason that they begin to appear, when the bubble is " thickest, and are most conveniently reckoned from the lowest and thickest part " of the bubble upwards.

" Obs. 19. Viewing, at several oblique positions of my eye, the rings of " colours emerging on the top of the bubble, I found, that they were sensibly " dilated by increasing the obliquity, but yet not so much by far, as those made " by thinned air in the seventh observation. For there they distended so much, " as, when viewed most obliquely, to arrive at a part of the plate more than " twelve lines thicker than that where they appeared, when viewed perpendicu- " larly; whereas in this case the thickness of the water, at which they arrived " when viewed most obliquely, was, to that thickness, which exhibited them by " perpendicular rays, something less than eight to five. By the best of my ob- " servations, it was between fifteen and fifteen and a half to ten, an increase " about twenty-four times less than in the other case.

" Sometimes the bubble would become of an uniform thickness all over, ex- " cept at the top of it near the black spot, as I knew, because it would exhibit " the same appearance of colours in all positions of the eye; and then the co- " lours, which were seen at its apparent circumference by the obliquest rays, " would be different from those, that were seen in other places by rays less " oblique to it. And divers spectators might see the same part of it of differing " colours, by viewing it at very differing obliquities. Now, observing how " much the colours at the same place of the bubble, or at divers places of equal " thickness, were varied by the several obliquities of the rays, by assistance of " the fourth, fourteenth, sixteenth, and eighteenth observations, as they are " hereafter explained, I collected the thickness of the water, requisite to exhibit " any one the same colour at several obliquities, to be very nearly in the propor- " portion expressed in this table.

Incidence on the water.		Refraction into the water.		Thickness of the water.
degr.	min.	degr.	min.	
00	00	00	00	10
15	00	11	11	$10\frac{1}{4}$
30	00	22	1	$10\frac{4}{5}$
45	00	32	2	$11\frac{4}{5}$
60	00	40	30	13
75	00	46	25	$14\frac{1}{2}$
90	00	48	35	$15\frac{1}{5}$

" In the two first columns are expressed the obliquities of the rays to the " superficies of the water; that is, their angles of incidence and refraction; " where, I suppose, that the lines, which measure them, are in round numbers, " as three to four, though probably the dissolution of soap in the water may a " little alter its refractive virtue. In the third column the thickness of the bubble,

 " at

"at which any one colour is exhibited in those several obliquities, is exprest in "parts, of which ten constitute that thickness, when the rays are perpendicular.

"I have sometimes observed of the colours, which arise on polished steel by "heating it, or on bell-metal and some other metalline substances, when melted "and poured on the ground, where it may cool in the open air, that they have, "like those of water-bubbles, been a little changed by viewing them at divers "obliquities; and particularly, that a deep blue or violet, when viewed very "obliquely, hath been changed to a deep red. But the changes of these colours "are not so sensible as of those made by water; for the scoria, or vitrified part "of the metal, which most metals, when heated or melted, continually protrude "to their surface, where, by covering them in form of a thin glassy skin, it "causes these colours, is much denser than water, and I find, that the change "made by the obliquation of the eye, is least in colours of the densest thin sub-"stances.

"Obs. 20. As in the ninth observation, so here, the bubble by transmitted "light appeared of a contrary colour to that, which it exhibited by reflection. "Thus, when the bubbles, being looked on by the light of the clouds reflected "from it, seemed red at its apparent circumference, if the clouds at the same "time, or very suddenly, were viewed through it, the colour at its circumfe-"rence would be blue. And, on the contrary, when by reflected light it ap-"peared blue, it would appear red by transmitted light.

"Obs. 21. By wetting plates of Muscovy-glass, whose thinness made the like "colours appear, the colours became more faint, especially by wetting the plates "on that side opposite the eye; but I could not perceive any variation of their "species. So that the thickness of a plate requisite to produce any colour, de-"pends only on the density of the plate, and not of the ambient medium. "And hence, by the tenth and sixteenth observations, may be known the thick-"ness of bubbles of water or plates of Muscovy-glass, or of any other substan-"ces, which they have at any colour produced by them.

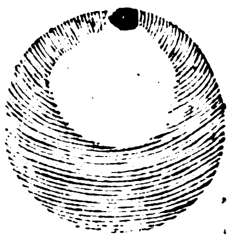
"Obs. 22. A thin transparent body, which is denser than its ambient me-"dium, exhibits more brisk and vivid colours than that, which is so much "rarer; as I have particularly observed in air and glass: for, blowing glass "very thin at a lamp furnace, those plates encompassed with air did exhibit co-"lours much more vivid than those of air made thin between two glasses.

"Obs. 23. Comparing the quantity of light reflected from the several rings, "I found it was most copious from the first or inmost, and in the exterior rings be-"came gradually less and less. Also the whiteness of the first ring was stronger than "that reflected from those parts of the thinned medium, which were without the "rings, as I could manifestly perceive by viewing at distance the rings made by "the two object-glasses; or by comparing two bubbles of water blown at distant "times, in the first of which the whiteness appeared, which succeeded the colours, "and the whiteness, which preceded them, in the other.

" Obf. 24. When the two object-glaffes were laid upon one another, fo as to make the rings of colours appear, though with my naked eye I could not difcern above eight or nine of thofe rings, yet, by viewing them through a prifm, I have feen a far greater multitude, infomuch, that I could number more than forty, befides many others, that were fo very fmall and clofe together, that I could not keep my eye fo fteady on them feverally as to number them: but by their extent I have fometimes eftimated them to be more than a hundred. And, I believe, the experiment may be improved to the difcovery of far greater numbers; for they feem to be really unlimited, though vifible only fo far as they can be feparated by the refraction, as I fhall hereafter explain.

" But it was but one fide of thefe rings, namely, that, towards which the refraction was made, which by that refraction was rendered diftinct; and the other fide became more confufed than to the naked eye, infomuch that there I could not difcern above one or two, and fometimes none of thofe rings, of which I could difcern eight or nine with my naked eye. And their fegments, or arcs, which on the other fide appeared fo numerous, for the moft part exceeded not the third part of a circle. If the refraction was very great, or the prifms very diftant from the object-glaffes, the middle part of thofe arcs became alfo confufed, fo as to difappear and conftitute an even whitenefs, whilft on either fide their ends, as alfo the whole arcs fartheft from the center, became diftincter than before, appearing in the form you fee them here defigned.

Fig. II.



" The arcs, where they feemed diftincteft, were only white and black fucceffively, without any other colours intermixed. But in other places there appeared colours whofe order was inverted by the refraction, in fuch manner, that, if I firft held the prifm very near the object-glaffes, and then gradually removed it farther off towards my eye, the colours of the fecond, third, fourth, and following rings fhrunk towards the white, that emerged between them, until they wholly vanifhed into it at the middle of the arcs, and afterwards emerged again in a contrary order: but at the end of the arcs they retained their order unchanged.

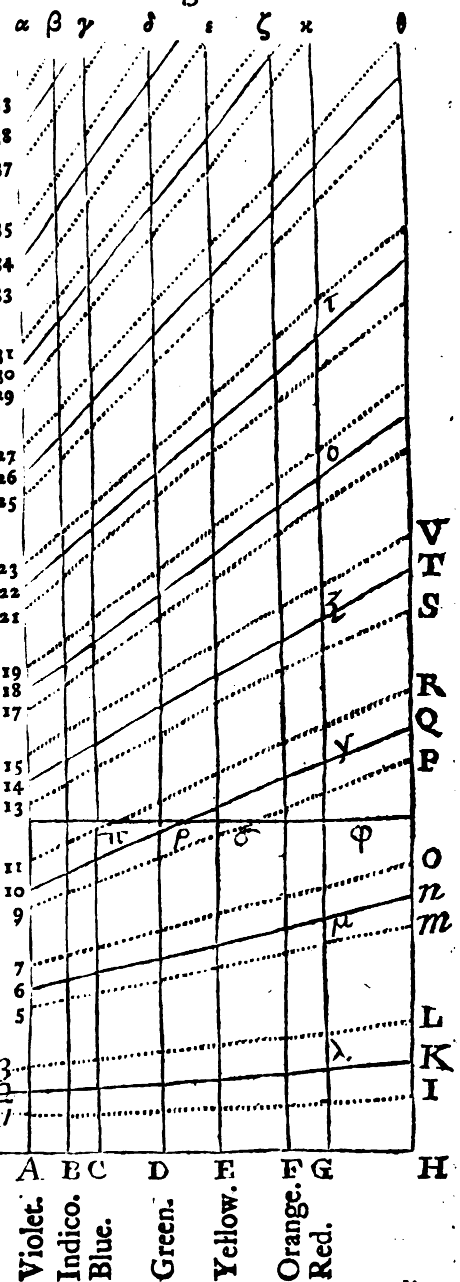
" I have fometimes fo laid one object-glafs upon the other, that, to the naked eye, they have all over feemed uniformly white, without the leaft appearance of any of the coloured rings; and yet, by viewing them through a prifm, great multitudes of thofe rings have difcovered themfelves. And, in like manner, plates of Mufcovy glafs, and bubbles of glafs blown at a lamp-furnace, which were not fo thin, as to exhibit any colours to the naked eye, have through the prifm exhibited a great variety of them, ranged irregularly up and down, in the form of waves. And fo bubbles of water, before they began to exhibit their colours to the naked eye of a by-ftander, have appeared, through a prifm, girded about with many parallel and horizontal rings; to produce which effect, it was neceffary to hold the prifm parallel, or very nearly parallel, to the horizon, and to difpofe it fo, that the rays might be refracted upwards.

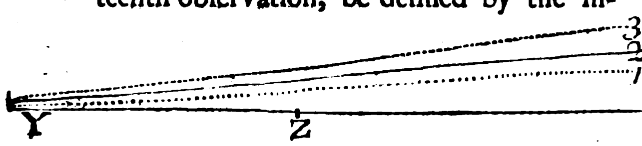
" Having

" Having given my obſervations of theſe colours, before I make uſe of them " to unfold the cauſes of the colours of natural bodies, it is convenient, that, by " the ſimpleſt of them, I firſt explain the more compounded; ſuch as are the " ſecond, third, fourth, ninth, twelfth, eighteenth, twentieth, and twenty-fourth.

" And firſt, to ſhow how the colours in the fourth and eighteenth obſervations " are produced, let there be taken in any " right line the lengths Y Z, Y A, and " Y H, in proportion as four, nine, and " fourteen; and between Z A and Z H " eleven mean proportionals, of which let " Z B be the ſecond, Z C the third, Z D " the fifth, Z E the ſeventh, Z F the ninth, " and Z G the tenth. And at the points " A, B, C, D, E, F, G, H, let perpendi- " diculars A α, B β, &c. be erected, by " whoſe intervals, the extent of the ſeveral " colours ſet underneath againſt them, is to " be repreſented. Then divide the line A α " in ſuch proportion as the numbers 1, 2, 3; " 5, 6, 7; 9, 10, 11, &c. ſet at the point " of diviſion denote. And through thoſe " diviſions from Y draw lines 1 I, 2 K, 3 L; " 5 *m*, 6 *n*, 7 *o*, &c.

Fig. III.





Now, if A 2 be ſuppoſed to repreſent the " thickneſs of any thin tranſparent body, " at which the utmoſt violet is moſt copi- " ouſly reflected in the firſt ring or ſeries of " colours, then, by the thirteenth obſerva- " tion, H K will repreſent its thickneſs, at " which the utmoſt red is moſt copiouſly " reflected in the ſame ſeries. Alſo, by the " fifth and ſixteenth obſervations, A 6, and " H *n*, will denote the thickneſs at which " thoſe extreme colours are moſt copiouſly " reflected in the ſecond ſeries, and ſo on. " And the thickneſs, at which any of the " intermediate colours are reflected moſt " copiouſly, will, according to the four- " teenth obſervation, be defined by the in-

" termediate

" termediate parts of the lines 2 K, 6 *n*, &c. against which the names of those
" colours are written below.

" But farther, to define the latitude of these colours in each ring or series, let
" A 1 design the least thickness, and A 3 the greatest thickness, at which the
" extreme violet in the first series is reflected; and let H I and H L design the
" like limit for the extreme red, and the intermediate colours be limited by the
" intermediate parts of the lines, 1 I and 3 L; against which the names of those
" colours are written. And in the second series, let those limits be the lines
" 5 M and 7 O; and so on: but yet with this caution, that the reflections be
" supposed strongest at the intermediate spaces, 2 K, 6 N, 10 R, &c. and to
" decrease gradually towards these limits, 1 I, 3 L, 5 M, 7 O, &c. on either
" side, where you must not conceive them to be precisely limited, but to decay
" indefinitely. And whereas I have designed the same latitude to every series, I
" did it, because, although the colours in the first series seem to be a little broader
" than the rest, by reason of a stronger reflection there; yet that inequality is so
" insensible as scarcely to be determined by observation.

" Now, according to this description, conceiving, that the rays, in which seve-
" ral colours in here, are by turns reflected at the space 1 K, 3 L, 5 M, O 7,
" 9 P, R 11, &c. and transmitted at the spaces A H I 1, 3 L, M 5, 7 O,
" P 9, &c. it is easy to know what colour in the open air must be exhibited
" at any thickness of a transparent thin body. For, if a ruler be applied paral-
" lel to A H, at that distance from it by which the thickness of the body is
" represented, the alternate spaces 1 I, L 3, 5 M, O 7, &c. which it crosseth,
" will denote the reflected original colours, of which the colour exhibited in the
" open air is compounded. Thus, if the constitution of the green in the third
" series of colours be desired; apply the ruler, as you see, at $\pi \rho \sigma \varphi$, and by its
" passing through some of the blue at π, and yellow at σ, as well as through the
" green ρ, you may conclude, that green, exhibited at that thickness of the
" body, is principally constituted of original green, but not without a mixture
" of some blue and yellow. By this means you may know, how the colours
" from the center of the rings outwards ought to succeed in order, as they were
" described in the fourth and eighteenth observations: for, if you move the ruler
" gradually from A H through all distances, having past over the first space,
" which denotes little or no reflection to be made by thinnest substances, it will first
" arrive at 1, the violet, and then very quickly at the blue and green, which, to-
" gether with that violet compounded blue, and then at the yellow and red, by
" whose further addition, that blue is converted into whiteness, which white-
" ness continues during the transit from I to 3; and after that, by the successive
" deficience of its component colours, turns first to compound yellow, and then
" to red, and last of all the red ceaseth at L. Then begin the colours of the second
" series, which succeed in order between 5 and O, and are more lively than be-
" fore, because more expanded and severed. And, for the same reason, instead of
" the former white, there intercedes between the blue and yellow a mixture of
" orange, yellow, green, blue and indico, all which together ought to exhibit
" a dilute an imperfect green. So the colours of the third series all succeed in
" order

" order; first the violet, which a little interferes with the red of the second or-
" der, and is thereby inclined to a redish purple; then the blue and green, which " are less mixed with other colours, and consequently more lively than before, " especially the green. Then follows the yellow, some of which towards the " green is distinct and good; but that part of it towards the succeeding red, as " also that red, is mixed with the violet and blue of the fourth series, whereby va- " rious degrees of red, very much inclining to purple, are compounded. The " violet and blue, which should succeed this red, being mixed with, and hidden " in it, there succeeds a green; and this at first is much inclined to blue, but " soon becomes a good green; the only unmixed and lively colour in this fourth " series: for as it verges towards the yellow, it begins to interfere with the " colours of the fifth series, by whose mixture the succeeding yellow and red are " very much diluted, and made dirty, especially the yellow, which being the " weaker colour, is scarce able to shew itself. After this the several series inter- " fere more and more, and their colours become more and more intermixed, till " after three or four revolutions (in which the red and blue predominate by " turns) all sorts of colours are in all places pretty equally blended, and com- " pound one even whiteness.

" And since, by the fifteenth observation, the rays indued with one colour are " transmitted, where those of another colour are reflected, the reason of the co- " lours made by the transmitted light, in the ninth and twentieth observations, is " also from hence evident.

" If not only the order and species of these colours, but also the precise thick- " ness of the plate, or thin body, at which they are exhibited, be desired in parts " of an inch, that may be also performed by assistance of the sixth or sixteenth " observation. For, according to those observations, the thickness of the thinned " air, which, between two glasses, exhibited the orange or bright red of the " sixth order, was $\frac{1}{14554}$ parts of an inch. Now, suppose this thickness be " represented by G τ, and the eleventh part of it, G λ, will be about $\frac{1}{160000}$ of " an inch. And so G μ, G V, G ξ, G o, will be $\frac{3}{160000}$, $\frac{5}{160000}$, $\frac{7}{160000}$, " and $\frac{9}{160000}$. And this being known, it is easy to determine what thickness " of air is represented by G φ, or any other distance of the ruler from A H.

" But further, since, by the tenth observation, the thickness of air was to the " thickness of water, which between the same glasses exhibited the same colour, " as four to three; and, by the twenty-first observation, the colours of thin " bodies are not varied by varying the ambient medium; the thickness of a " bubble of water exhibiting any colour will be three fourths of the thickness of " air producing the same colour. And so, according to the same tenth and twenty- " first observations, the thickness of a plate of glass, whose refraction is measured " by the proportion of the sines thirty-one to twenty, may be $\frac{20}{31}$ of the thickness " of air producing the same colours: and the like of other mediums. On these " grounds I have composed the following table; wherein the thickness of air, " water, and glass, at which each colour is most intense and specific, is expressed " in parts of an inch divided into ten hundred thousand equal parts.

" The

		The thickness of		
		Air	Water	Glass
The colours of the first order	Black	2	$1\frac{1}{2}$	$1\frac{1}{4}$ or less.
	Blue	$2\frac{2}{3}$	2	$1\frac{3}{4}$
	White	$5\frac{1}{3}$	4	$3\frac{1}{2}$
	Yellow	8	6	$5\frac{1}{4}$
	Orange	9	$6\frac{3}{4}$	$5\frac{4}{5}$
	Red	10	$7\frac{1}{2}$	$6\frac{1}{2}$
Of the second order	Violet	12	9	$7\frac{1}{4}$
	Indico	$13\frac{1}{4}$	$9\frac{11}{12}$	$8\frac{1}{2}$
	Blue	$14\frac{3}{4}$	11	$9\frac{1}{2}$
	Green	16	12	$10\frac{1}{3}$
	Yellow	$17\frac{1}{2}$	$13\frac{1}{8}$	$11\frac{1}{3}$
	Orange	$19\frac{1}{4}$	$14\frac{1}{2}$	$12\frac{2}{5}$
	Bright red	20	15	13
	Scarlet	$21\frac{1}{4}$	16	$13\frac{2}{3}$
Of the third order	Purple	23	$17\frac{1}{4}$	$14\frac{4}{5}$
	Indico	24	18	$15\frac{1}{2}$
	Blue	$25\frac{1}{5}$	19	$16\frac{1}{4}$
	Green	$27\frac{1}{5}$	$20\frac{2}{5}$	$17\frac{1}{2}$
	Yellow	$29\frac{1}{2}$	22	19
	Red	31	$23\frac{1}{4}$	20
	Bluish red	$33\frac{1}{2}$	25	$21\frac{2}{3}$
Fourth order	Bluish	36	27	$23\frac{1}{4}$
	Green	$37\frac{2}{3}$	$28\frac{1}{4}$	$24\frac{1}{3}$
	Yellowish green	$39\frac{1}{3}$	$29\frac{1}{2}$	$25\frac{1}{3}$
	Red	44	33	$28\frac{1}{3}$
Fifth order	Greenish blue	$50\frac{2}{3}$	38	$32\frac{2}{3}$
	Red	$57\frac{1}{3}$	43	37
Sixth order	Greenish blue	64	48	$41\frac{1}{3}$
	Red	$70\frac{2}{3}$	53	$45\frac{2}{3}$
Seventh order	Greenish blue	$77\frac{1}{3}$	58	50
	Red or White	84	63	$54\frac{1}{2}$

" Now, if this table be compared with the third scheme, you will there see " the constitution of each colour, as to its ingredients, or the original colours, " of which it is compounded, and thence be enabled to judge of its intenseness " or imperfection, which may suffice in explication of the fourth and eighteenth " observa-

"observations, unless it be further desired to delineate the manner, how the "colours appear, when the two object-glasses are laid upon one another: to do "which let there be described a large arc of a circle and a strait line, which "may touch that arc; and parallel to that tangent several occult lines at such "distances from it, as the numbers set against the several colours in the table "denote. For the arc and its tangent will represent the superficies of the "glasses, terminating the interjacent air, and the places, where the occult lines "cut the arc, will show at what distances from the center, or point of the con-"tact, each colour is reflected.

"There are also other uses for this table; for by its assistance the thickness "of the bubble, in the nineteenth observation, was determined by the colours, "which it exhibited. And so the bigness of the parts of natural bodies may be "conjectured at by their colours, as shall be hereafter shown. Also, if two "or more very thin plates be laid one upon another, so as to compose one plate, "equalling them all in thickness, the resulting colour may be hereby determined. "For instance, Mr. HOOKE, in his Micrographia, observes, that a faint yellow "plate of Muscovy glass, laid upon a blue one, constituted a very deep purple. "The yellow of the first order is a faint one, and the thickness of the plate ex-"hibiting it, according to the table, is $5\frac{1}{4}$, to which add $9\frac{1}{2}$, the thickness ex-"hibiting blue of the second order, and the sum will be $14\frac{3}{4}$, which most "nearly approaches $14\frac{4}{5}$, the thickness exhibiting the purple of the third "order.

"To explain, in the next place, the circumstances of the second and third "observations, that is, how the colours (by turning the prisms about their com-"mon axis the contrary way to that expressed in those observations) may be con-"verted into white and black rings, and afterwards into colours again in an "inverted order; it must be remembered, that those colours are dilated by obli-"quation of rays to the air, which intercedes the glasses; and that, according "to the table in the seventh observation, their dilatation or reflection from the "common center is most manifest and speedy when they are obliquest. Now, "the rays of yellow being more refracted by the first superficies of the said air "than those of red, are thereby made more oblique to the second superficies, "at which they are reflected, to produce the coloured rings; and consequently, "the yellow in each ring will be more dilated than the red; and the excess of "its dilatation will be so much the greater, by how much the greater is the obli-"quity of the rays, until at last it become of equal extent with the red of the "same ring. And, for the same reason, the green, blue, and violet, will be "also so much dilated by the still greater obliquity of their rays, as to become "all very nearly of equal extent with the red; that is, equally distant from the "center of the rings. And then all the colours of the same series must be coinci-"dent, and by their mixture exhibit a white ring; and these white rings must "have black or dark rings between them, because they do not spread and inter-"fere with one another as before; and, for that reason also, they must become "distincter, and visible to far greater numbers. But yet the violet, being

"obliquest,

" obliqueſt, will be ſomething more dilated in proportion than the other colours, " and ſo very apt to appear at the exterior verges of the white.

" Afterwards, by a greater obliquity of the rays, the violet and the blue be- " come ſenſibly more dilated than the red and yellow; and ſo being further " removed from the center of the rings, the colours muſt emerge out of the white " in an order contrary to that which they had before, the violet and blue at the " exterior limbs, and the red and yellow at the interior. And the violet, by " reaſon of the greateſt obliquity of its rays, being, in proportion, moſt of all " expanded, will ſooneſt appear at the exterior limb of each white ring, and " become more conſpicuous than the reſt. And the ſeveral ſeries of colours, by " their unfolding and ſpreading, will begin again to interfere, and thereby render " the rings leſs diſtinct, and not viſible to ſo great numbers.

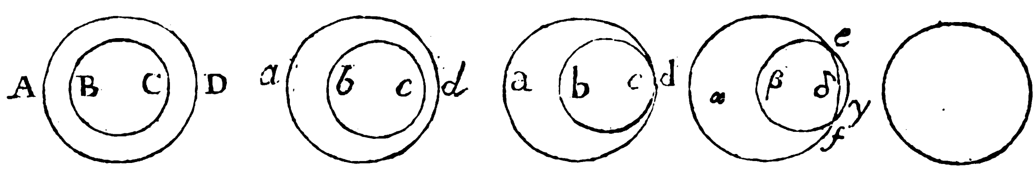
" If, inſtead of the priſms, the object-glaſſes be made uſe of, the rings, which " they exhibit, become not white and diſtinct by the obliquity of the eye, by " reaſon, that the rays, in their paſſage through that air, which interceded the " glaſſes, are very nearly parallel to themſelves, when firſt incident on the glaſſes; " and conſequently, thoſe indued with ſeveral colours are not inclined one more " than another to that air, as it happens in the priſms.

" There is yet another circumſtance of theſe experiments to be conſidered; " and that is, why the black and white rings, which, when viewed at a diſtance, " appear diſtinct, ſhould not only become confuſed by viewing them near at " hand, but alſo yield a violet colour at both the edges of every white ring: " and the reaſon is, that the rays, which enter the eye at ſeveral parts of the " pupil, have ſeveral obliquities to the glaſſes, and thoſe, which are moſt oblique, " if conſidered apart, would repreſent the rings bigger than thoſe, which are the " leaſt oblique. Whence the breadth of the perimeter of every white ring is ex- " panded outwards by the obliqueſt rays, and inwards by the leaſt oblique. And " this expanſion is ſo much the greater, by how much the greater is the difference " of the obliquity; that is, by how much the pupil is wider, or the eye nearer " to the glaſſes: and the breadth of the violet muſt be moſt expanded, becauſe " the rays, apt to excite a ſenſation of that colour, are moſt oblique to the " ſecond or further ſuperficies of the thinned air, at which they are reflected; " and have alſo the greateſt variation of obliquity, which makes that colour " ſooneſt emerge out of the edges of the white. And, as the breadth of every " ring is thus augmented, the dark intervals muſt be diminiſhed, until the neigh- " bouring rings become continuous, and are blended, the exterior firſt, and " then thoſe nearer the center; ſo that they can no longer be diſtinguiſhed a-part, " but ſeem to conſtitute an even and uniform whiteneſs.

" Amongſt all the obſervations there is none accompanied with ſo odd circum- " ſtances as the twenty-fourth. Of thoſe the principal are, that in thin plates, " which, to the naked eye, ſeem of an even and uniform tranſparent whiteneſs, " the refraction of a priſm ſhould make the rings of colours appear; whereas it " uſually makes objects to appear coloured only, where they are terminated with

“ ſhadows, or have parts unequally luminous; and that it ſhould make thoſe
“ rings exceedingly diſtinct and white, although it uſually renders thoſe objects
“ confuſed and coloured. The cauſe of theſe things you will underſtand by
“ conſidering, that all the rings of colours are really in the plate, when viewed
“ by the naked eye, although, by reaſon of the great breadth of their circum-
“ ferences, they ſo much interfere, and are blended together, that they ſeem to
“ conſtitute an even whiteneſs. But, when the rays paſs through the priſm to
“ the eye, the orbits of the ſeveral colours in every ring are refracted, ſome more
“ than others, according to their degree of refrangibility; by which means the
“ colours on one ſide of the ring become more unfolded and dilated, and on the
“ other ſide more complicated and contracted. And where, by a due refrac-
“ tion, they are ſo much contracted, that the ſeveral rings become narrower
“ than to interfere with one another, they muſt appear diſtinct, and alſo white,
“ if the conſtituent colours be ſo much contracted as to be wholly coinci-
“ dent: but on the other ſide, where every ring is made broader by the further
“ unfolding its colours, it muſt interfere more with other rings than before, and
“ ſo become leſs diſtinct.

“ To explain this a little further; ſuppoſe the concentric circles, A B and
“ C D, repreſent the red and violet of any order, which, together with the in
“ termediate colours, conſtitute any one of theſe rings. Now, theſe being
“ viewed through a priſm, the violet circle, B C, will, by a greater refraction, be
“ further tranſlated from its place than the red, A D, and ſo approach nearer



“ to it on that ſide towards which the refractions are made. For inſtance, if
“ the red be tranſlated to *a d*, the violet may be tranſlated to *b c*, ſo as to ap-
“ proach nearer to it at *c* than before; and, if the red be further tranſlated to
“ a d, the violet may be ſo much further tranſlated to b c, as to convene with
“ it at c, and, if the red be yet further tranſlated to α δ, the violet may be ſtill
“ ſo much further tranſlated to β γ, as to paſs beyond it at γ, and convene with it
“ at *e* and *f*. And this being underſtood, not only of the red and violet, but of
“ all the other intermediate colours; and alſo of every revolution of thoſe co-
“ lours, you will eaſily perceive, how theſe of the ſame revolution or order, by
“ their narrowneſs at *c d*, and δ γ, and their coincidence at *c d*, *e* and *f*, ought
“ to conſtitute pretty diſtinct arcs of circles, eſpecially at *c d*, or at *e* and *f*, and
“ that they will appear ſeveral at *c d*, at c d exhibit whiteneſs by their coinci-
“ dence, and again appear ſeveral at δ γ, but yet in a contrary order to that
“ which they had before, and ſtill retain beyond *e* and *f*. But, on the other
“ ſide, at *a b*, a b, or α β, theſe colours muſt become much more confuſed by
“ being dilated, and ſpread ſo as to interfere with thoſe of other orders. And
“ the ſame confuſion will happen at δ γ between *e* and *f*, if the refraction be
“ very

" very great, or the prism very distant from the object-glasses; in which case no " parts of the ring will be seen, save only two little arcs at *e* and *f*, whose distance " from one another will be augmented by removing the prism still further from " the object-glasses. And these little arcs must be distinctest and whitest at their " middle; and at their ends, where they grow confused, they must be coloured; " and the colours at one end of every arc must be in a contrary order to those " at the other end, by reason that they cross in the intermediate white; namely, " their ends, which verge towards $\delta\ \gamma$, will be red, and yellow on that side next " the center, and blue and violet on the other side. But their other ends, which " verge from $\delta\ \gamma$, will, on the contrary, be blue and violet on that side towards " the center, and on the other side red and yellow.

" For confirmation of all this, I need alledge no more, than that it is mathe-" matically demonstrable from my former principles. But I shall add, that they, " which please to take the pains, may by the testimony of their senses be assured, " that these explications are not hypothetical, but infallibly true and genuine: " for in a dark room, by viewing these rings through a prism, by reflection of " the several prismatic colours, which an assistant causes to move to and fro " upon a wall or paper, from whence they are reflected, whilst the spectator's " eye, the prism, and object-glasses (as in the thirteenth observation) are placed " steddy, the position of the circles, made successively by the several colours, " will be found such, in respect of one another, as I have described at *a b c d*, or " a b c d, or $\alpha\ \beta\ \gamma\ \delta$. And by the same method the truth of the explications of " the other observations is to be examined.

" By what hath been said, the like phænomena of water-bubbles and thin " plates of glass may be understood. But in small fragments of those plates, " there is this further observable, that, if they, lying flat upon a table, be turned " about their center, whilst they are viewed through a prism, some of them ex-" hibit waves in one or two positions only; but the most of them do in all posi-" tions exhibit those waves, and that for the most part appearing almost all over " the glass. The reason is, that the superficies of such plates are not even, but " have many cavities and swellings, which, how shallow soever, do a little vary " the thickness of the plate; and by the several sides of those cavities there " must be produced waves in several postures of the prism. Now, though it " be but some very small and narrow parts of the glass, by which these waves " for the most part are caused, yet they may seem to extend themselves over the " whole glass, because from the narrowest of those parts there are colours of several " orders confusedly reflected, which by refraction of the prism are unfolded, and " dispersed to several places, so as to constitute so many several waves as there " were divers orders of the colours promiscuously reflected from that part of the " glass.

" These are the principal phænomena of thin plates or bubbles, whose expli-" cations depend on the properties of light, that I have heretofore delivered: " and these, you see, do necessarily follow from them, and agree with them even " to their very least circumstances; and not only so, but do very much tend to

" their

" their proof. Thus, by the twenty-fourth obſervation, it appears, that the " rays of ſeveral colours, made, as well by thin plates or bubbles, as by the re- " fractions of a priſm, have ſeveral degrees of refrangibility, whereby thoſe of " each order, which, at their reflection from the plate or bubble, are intermixed " with thoſe of other orders, are ſeparated from them by refraction, and aſſoci- " ated together, ſo as to become viſible by themſelves, like arcs of circles. For, " if the rays were all alike refrangible, it is impoſſible, that the whiteneſs, which " to the naked ſenſe appears uniform, ſhould by refraction have its parts tranſ- " poſed, and ranged into thoſe black and white arcs.

" It appears alſo, that the unequal refractions of difform rays proceed not " from any contingent irregularities, ſuch as are veins, an uneven poliſh, or for- " tuitous poſition of the pores of glaſs, unequal motions in the air or æther, " ſpreading, breaking, or dividing the ſame ray into many diverging parts, or " the like. For, admitting any ſuch irregularities, it would be impoſſible for " refractions to render thoſe rings ſo very diſtinct and well defined, as they do " in the twenty-fourth obſervation. It is neceſſary therefore, that every ray have " its proper and conſtant degree of refrangibility connate with it; according to " which its refraction is ever juſtly and regularly performed, and that ſeveral " rays have ſeveral of thoſe degrees.

" And what is ſaid of their refrangibility may be underſtood of their reflexi- " bility; that is, of their diſpoſitions to be reflected, ſome at a greater, and others " at a leſs thickneſs of thin plates or bubbles, namely, that thoſe diſpoſitions are " alſo connate with the rays, and immutable, as may appear by the thirteenth, " fourteenth, and fifteenth obſervations, compared with the fourth and eigh- " teenth.

" By the precedent obſervations it appears alſo, that whiteneſs is a diſſimilar " mixture of all colours, and that light is a mixture of rays endowed with all " thoſe colours. For, conſidering the multitude of the rings of colours in the " third, twelfth, and twenty-fourth obſervations, it is manifeſt, that, although " in the fourth and eighteenth obſervations there appear more than eight or nine " of thoſe rings, yet there are really a far greater number, which ſo much inter- " fere and mingle with one another, as, after thoſe eight or nine revolutions, to " dilute one another wholly, and conſtitute an even and ſenſible uniform white- " neſs. And conſequently, that whiteneſs muſt be allowed a mixture of all co- " lours, and the light, which conveys it to the eye, muſt be a mixture of rays " endued with all thoſe colours.

" But further, by the twenty-fourth obſervation it appears, that there is a con- " ſtant relation between colours and refrangibility, the moſt refrangible rays being " violet, the leaſt refrangible red, and thoſe of intermediate colours having pro- " portionally intermediate degrees of refrangibility. And, by the thirteenth, " fourteenth, and fifteenth obſervations, compared with the fourth or eighteenth, " there appears to be the ſame conſtant relation between colour and refrangi- " bility; the violet being on equal terms reflected at leaſt thickneſs of any thin

" plate

" plate or bubble; the red at greateſt thickneſs, and the intermediate colours at " intermediate thickneſſes: whence it follows, that the colorific diſpoſitions of " rays are alſo connate with them, and immutable; and by conſequence, that all " the productions and appearances of colours in the world are derived, not from " any phyſical change cauſed in light by refraction or reflection, but only from " the various mixtures or ſeparations of rays, by virtue of their different refran- " gibility or reflexibility. And, in this reſpect it is, that the ſcience of colours " becomes a ſpeculation more proper for mathematicians than naturaliſts.

This being read, occaſion was taken to diſcourſe of Mr. Newton's theory itſelf, and to debate, whether the rays of light, which, though alike incident in the ſame medium, yet exhibit different colours, may not reaſonably be ſaid to owe that exhibition of different colours to the ſeveral degrees of the velocity of pulſes, rather than, as Mr. Newton thought, to the ſeveral connate degrees of refrangibility in the rays themſelves?

Mr. Hooke was of opinion, that the former of theſe ways was ſufficient to give a good account of the diverſity of colours.

February 10. Dr. Mapletoft was elected and admitted.

Capt. Sheeres, Mr. Hall, and Signor Travagino were elected.

Mr. Berchenshaw preſented himſelf to the Society, and ſhewed them his ſcale of muſic, wherein were contained,

1. A table of all conſonant and diſſonant intervals ſuitable to muſical harmony, which are practicable, and may be expreſſed by the voice and other inſtruments. To theſe reſpective intervals apt and proper numbers were aſſigned, by which their ratio's and proportions were demonſtrated.

2. A ſyſtem of all the keys, by which the aforeſaid intervals were completed; of which keys ſome were natural; ſome intended to the firſt degree of acuteneſs; ſome remitted to the firſt degree of gravity; ſome twice ſpiſſated; ſome twice aſperated.

3. In this ſcale the magnitude, dimenſion, and proportion of the ſaid keys were exactly demonſtrated according to the proportional parts of a chord, the chord being ſuppoſed thirty-ſix inches long.

If it were demanded, whether there was any thing in this table and ſyſtem, that was not to be found in the ſcales and writings of other muſicians? he anſwered,

1. That the intervals in this table were perfect and complete. There was not one too many, nor one wanting, which might conduce to the making of harmony.

2. That

2. That the founds or mufical numbers contained in this fyftem arofe out of the unifon, and from one another, according to the reafon of figurate, not fimple numbers, (as, he faid, he could demonftrate by numbers affigned to the refpective intervals in the table) for that fo the reafon of the ftate of mufic required.

3. That there are neither more or lefs keys in this fyftem, than would complete the aforefaid intervals.

4. That in this fcale all the tones are of the fame ratio, and that fo are all the femitones, femiditones, ditones, and other intervals.

5. That the true magnitude and dimenfion of every one of the faid keys are demonftrated according to the proportional parts of a chord.

6. That the natural, genuine, and true reafon of the excellency and fullnefs of the harmony of three, four, five, fix, and feven parts, may clearly be difcerned by the fyftem of feven parts.

He added, that many other things were to be found in this table and fcale, of which little or no mention is made in the fcales and writings of either modern or antient mufical authors; which, he faid, he intended to difcover, and to write of them at large, as he fhould be enabled thereunto.

He was exhorted to finifh this work, or at leaft to publifh this fyftem with an explanation thereof.

After this was read the laft part of Mr. Newton's *obfervations*, wherein he confidered in nine propofitions, how the phænomena of thin tranfparent plates ftand related to thofe of all other natural bodies: of which bodies having before mentioned, that they appear of divers colours, according as they are difpofed to reflect moft copioufly the rays indued with thefe colours, he now inquires after their conftitutions.

Here, among many other confiderable things, he fhews, how the bignefs of the component parts of natural bodies may be conjectured by their colours: as alfo, that the caufe of reflexion is not the impinging of light on the folid and impervious parts of bodies, as was commonly fuppofed.

This laft part was as follows:

" I am now come to the laft part of this defign; which is, to confider, how " the phænomena of thin tranfparent plates ftand related to thofe of all other na- " tural bodies. Of thefe bodies I have already told you, that they appear of di- " vers colours, accordingly as they are difpofed to reflect moft copioufly the rays " endued with thofe colours. But their conftitutions, whereby they reflect fome rays

" more

" more copiously than others, remains to be inquired after. And this I shall en-
" deavour in the following propositions.

" Prop. 1. Those superficies reflect the greatest quantity of light, which have " the greatest refracting power; that is, which interceeds mediums, that differ most " in their refracting densities; and in the confines of equally dense mediums there " is no reflection.

" The analogy between reflection and refraction will appear by considering, that " when light passeth obliquely out of one medium into another, which refracts " from the perpendicular, the greater is the difference of their density, the less " obliquity is requisite to cause a total reflection; because as the sines are, which " measure the refraction, so is the sine of incidence, at which the total reflection " begins, to the radius of the circle; and consequently that incidence is least, " where there is the great difference of the sines. Thus in the passing of light out " of water into air, where the refraction is measured by the ratio of the sines, 3 to " 4, the total reflection begins, when the angle of the incidence is about forty-" eight degrees and thirty-five minutes. In passing out of glass into air, where " the refraction is measured by the ratio of the sines 20 to 31, the total reflection " begins, when the angle of incidence is forty degrees and ten minutes: and so, " in passing out of crystal, or more strongly refracting mediums, into air, there " is still a less obliquity requisite to cause a total reflection. Superficies therefore, " which refract most, do soonest reflect all the light, which is incident on them, " and so must be allowed most strongly reflective.

" But the truth of this proposition will further appear, by observing, that in " the superficies, interceeding any two of those mediums, air or water, or other " liquors, common glass, crystal, and metalline glasses, the reflection is stronger " or weaker accordingly as the superficies hath a greater or less refracting power. " Thus, when other mediums are contiguous to air, the reflection is stronger " in the superficies of glass than of water, still stronger in the superficies of crys-" tal, and strongest in the superficies of metalline glass. So, in the confine of " water and common glass, the reflection is very weak, but yet stronger than in " the confine of water and oil, or almost any other two liquors, and still stronger " in the confine of water and crystal, or metalline glass: accordingly as those " mediums differ more or less in density, so in the confine of common glass and " crystal there is a weak reflection, and a stronger reflection in the confine of " common and metalline glass: but in the confine of two glasses of equal den-" sity, there is not any sensible reflection, as was shewn in the first observation. " And the same may be understood of the superficies of two crystals or liquors, " or any other substances, in which no refraction is caused: whence it comes to " pass, that uniform mediums have no sensible reflexion but in their external su-" perficies, where they are adjacent to their mediums of a different density.

" Prop. 2. The least parts of natural bodies are in some measure transparent; " and the opacities of those bodies arise from the multitude of reflections caused " in their internal parts.

"That this is so, will easily be granted by them, that have been conversant with "microscopes: and it may be also tried by applying any substance to a hole, through "which the light is emitted into a dark room; for how opake soever that sub- "stance may seem in the open air, it will, by that means, appear very manifestly "transparent, if it be of a sufficient thickness: only metalline bodies must be ex- "empted, which, by reason of their excessive density seem to reflect almost all the "light incident on their first superficies.

"Prop. 3. Between the parts of opake or coloured bodies are many interstices, "replenished with mediums of other densities, as water between the tinging cor- "puscles, wherewith any liquor is impregnated; air between the aqueous globules "that constitute clouds or mists; and for the most part spaces void of both air "and water; but yet perhaps replenished with some subtiler medium between "the parts of hard bodies.

"The truth of this is evinced by the two precedent propositions: for by the "second proposition there are many reflections from the internal part of bodies, "which by the first proposition would not happen, if the parts of those bodies "were continued without any such interstices between them, because reflections "are caused only in superficies, which interceed mediums of a different density.

"But further, that this discontinuity of parts is the principal cause of the opa- "city of bodies, will appear by considering, that opake substances become trans- "parent by filling their pores with any substance of equal, or almost equal density "with their parts. Thus paper dipped in water or oil, the oculus mundi stone "steeped in water, linen-cloth oiled or varnished, and many other substances soaked "in such liquors, as will intimately pervade their little pores, become by that "means more transparent than otherwise. So, on the contrary, the most trans- "parent substances may, by separating their parts, be rendered sufficiently opake; "as glass, by being reduced to powder, or otherwise flawed, water by being form- "ed into many small bubbles, either alone in the form of froth, or by shaking "it together with oil of turpentine, or some other convenient liquor, with which "it will not incorporate, and horn by being scraped.

"To the increase of the opacity of these bodies it conduces something, that by "the twenty third observation, the reflections of very thin transparent substances "are considerably stronger than those made by the same substances of a greater "thickness. And to the reflection of solid bodies it may be further added, that "the interstices of their parts are void of air. For that for the most part they "are so, is reasonable to believe, considering the ineptitude, which air hath to "pervade small cavities, as appears by the ascension of water in slender glass- "pipes, paper, cloth, and other such like substances, whose pores are found too "small to be replenished with air, and yet large enough to admit water; and by "the difficulty, wherewith air pervades the pores of a bladder, through which "water find ready passage. And according to the eleventh observation, the ca- "vities thus void of air will cause the same kind of effects as to reflection, which "those do, that are replenished with it; but yet something more manifestly, be-

"cause

" cause the medium in relation to refractions is rarest, when most empty of air, " as Mr. HOOKE hath proved in his Micrographia; in which book he hath also " largely discoursed of this and the precedent proposition, and delivered many " other very excellent things concerning the colours of thin plates, and other na-" tural bodies, which I have not scrupled to make use of so far as they were for " my purpose.

" Prop. 4. The parts of bodies and their interstices must not be less than " of some definitive bigness, to render them opake and coloured; for the opakest " bodies, if their parts be subtilly divided (as metals by being dissolved in acid " menstruums, &c.) become perfectly transparent. And you may also remem-" ber, that in the eighth observation there was no reflection at the superficies of " the object-glasses, where they were very near one another, though they did not " absolutely touch. And in the seventeenth observation, the reflection of the " water-bubble, where it became thinnest, was almost insensible, so as to cause the " apparitions of very black spots.

" On these grounds I conceive it is, that water, salt, glass, stones, and such " like substances, are transparent; for, upon divers considerations, they seem to " be as porous as other bodies, but yet their pores and parts too small to cause " any opacity.

" Prop. 5. The transparent parts of bodies, according to their several sizes, " must *reflect* rays of one colour, and *transmit* those of another, on the same " grounds, that thin plates or bubbles do reflect or transmit those rays: and this " I take to be the ground of all their colours.

" For, if a thinned or plated body, which being of an even thickness appears " all over of one uniform colour, should be broken into fragments of the same " thickness with the plate, I see no reason, why a heap of those fragments should " not constitute a powder of the same colour, which the plate exhibited before it " was broken. And the parts of all natural bodies, being like so many fragments " of a plate, must on the same grounds exhibit the same colours.

" Now, that they do so, will further appear by the affinity of their proper-" ties: as that the infusion of nephritic-wood, and many other substances reflect " one colour, and transmit another, like thin bodies in the ninth and twentieth " observations. That the colours of silks, cloaths, and others substances, which " water or oil can intimately penetrate, become more faint and obscure by being " emerged in those liquors, and recover their vigour again by being dried, much " after the manner declared of thin bodies, in the tenth and twenty first obser-" vations: and that some of those coloured powders, which painters use, may have " their colours a little changed, by being very elaborately and finely ground. " Where I see not, what can be justly pretended for those changes, besides the " breaking of their parts into less parts by that contrition, after the same manner " that the colour of a plate is changed by varying its thickness. For which rea-" son also it is, that many flowers, by being bruised, become more transparent

" than before, or, at leaſt, in ſome degree or other, change their colours. Nor " is it much leſs to my purpoſe, that, by mixing divers liquors, very odd and " remarkable productions and changes of colours may be effected, of which no " cauſe can be more obvious and natural, than that the ſaline corpuſcles of one " liquor do variouſly act upon, or unite with, the tinging corpuſcles of another; " ſo as to make them ſwell or ſhrink (whereby not only their bulk, but their " denſity alſo may be changed) or to divide them into ſmaller corpuſcles, or make " many of them aſſociate into one cluſter; for we ſee how apt thoſe ſaline men- " ſtruums are to penetrate and diſſolve ſubſtances, to which they are applied; and " ſome of them to precipitate what others diſſolve. In like manner, if we con- " ſider the various phænomena of the atmoſphere, we may obſerve, that when " vapours are firſt raiſed, they hinder not the tranſparency of the air, being di- " vided into parts too ſmall to cauſe any reflection in their ſuperficies: but when, " in order to compoſe drops of rain, they began to coaleſce and conſtitute glo- " bules of all intermediate ſizes, thoſe globules, when they become of a conveni- " ent ſize to reflect ſome colours, and tranſmit others, may conſtitute clouds of " various colours, according to their ſizes. And I ſee not what can be rationally " conceived, in ſo tranſparent a ſubſtance as water for the production of theſe " colours, beſides the various ſizes of its parcels, which ſeem to affect a globular " figure moſt; but yet perhaps not without ſome inſtability in the ſmalleſt of " them, by reaſon that thoſe are moſt eaſily agitated by heat or any trembling mo- " tions in the air.

" Prop. 6. The parts of bodies, on which their colours depend, are denſer than " the medium, which pervades their interſtices.

" This will appear by conſidering, that the colour of a body depends not only " on the rays, which are incident perpendicularly or its parts, but on thoſe alſo, " which are incident at all other angles. And that, according to the ſeventh " obſervation, a very little variation of obliquity will change the reflected colour, " where the thin body or ſmall particle is rarer than the ambient medium, in- " ſomuch that ſuch a ſmall particle will, at diverſly oblique incidents, reflect all " ſorts of colours, in ſo great a variety, that the colour, reſulting from them all " confuſedly reflected from a heap of ſuch particles, muſt rather be a white or " grey, than any other colour, or at beſt it muſt be but a very imperfect and " dirty colour; whereas, if the thin body or ſmall particle be much denſer than " the ambient medium, the colours, according to the nineteenth obſervation, are " ſo little changed by the variation of obliquity, that the rays, which are re- " flected leaſt obliquely, may predominate over the reſt ſo much, as to cauſe a " heap of ſuch particles to appear very intenſly of their colour.

" It conduces alſo ſomething to this propoſition, that, according to the twenty- " ſecond obſervation, the colours exhibited by the denſer thin body within the " rarer are more briſk than thoſe exhibited by the rarer within the denſer.

" Prop. 7. The bigneſs of the component parts of natural bodies may be " conjectured by their colours.

" For ſince the parts of theſe bodies, by propoſition 5. do moſt probably ex-
" hibit the ſame colours with a plate of equal thickneſs, provided they have the
" ſame refractive denſity; and ſince their parts ſeem for the moſt part to have
" much the ſame denſity with water or glaſs, as by many circumſtances is obvious
" to collect: to determine the ſizes of theſe parts, you need only have recourſe
" to the precedent tables, in which the thickneſs of water or glaſs exhibiting any
" colour is expreſſed. Thus, if it be deſired to know the diameter of a cor-
" puſcle, which being of equal denſity with glaſs, ſhall reflect green of the third
" order; the number $17\frac{1}{2}$ ſhows it to be about $\frac{17\frac{1}{2}}{1000000}$ parts of an inch.

" The greateſt difficulty is here to know, of what order the colour of any
" body is; and for this end we muſt have recourſe to the fourth and eighteenth
" obſervations, from whence may be collected theſe particulars.

" *Scarlets*, and other *reds*, *oranges* and *yellows*, if they be pure and intenſe, are
" moſt probably of the ſecond order. Thoſe of the firſt and third order alſo may
" be pretty good; only the orange and red of the third order have too great a
" mixture of violet and blue.

" There may be good *greens* of the fourth order, but the pureſt are of the third:
" and of this order the green of all vegetables ſeems to be, partly by reaſon of
" the intenſeneſs of their colours, and partly becauſe when they wither, ſome of
" them turn to a greeniſh yellow, and others to a more perfect yellow or orange,
" or perhaps to red; paſſing firſt through all the aforeſaid intermediate colours,
" which changes ſeem to be effected by the exhaling of the moiſture, which may
" leave the tinging corpuſcles more denſe, and ſomething augmented by the ac-
" cretion of the oily and earthy part of that moiſture. Now the green, without
" doubt, is of the ſame order with thoſe colours, into which it changeth, becauſe
" the changes are gradual, and thoſe colours, though uſually not very pure, yet
" for the moſt part are too pure and lively to be of the fourth order.

" *Blues* and *purples* may be either of the ſecond or third order; but the beſt are
" of the third. Thus the colour of *violet* ſeems to be of that order; becauſe
" their ſyrup, by acid liquors, turns red, and by urinous and alkalazite turns
" green. For ſince it is of the nature of acids to diſſolve or attenuate, and of
" alcalis to precipitate or incraſſate, if the purple colour of the ſyrup was of
" the ſecond order, an acid liquor by attenuating its tinging corpuſcles would tinge
" it to a red of the firſt order, and an alcali, by incraſſating them, would change
" it to a green of the ſecond order; which red and green, eſpecially the green,
" ſeem too imperfect to be the colours produced by theſe changes. But if the
" ſaid purple be ſuppoſed of the third order, its change to red of the ſecond
" and green of the third may, without any inconvenience, be allowed.

" If there be found any body of a deeper and leſs reddiſh purple than that of
" violets, its colour moſt probably is of the ſecond order. But yet there being
" no body commonly known, whoſe colour is conſtantly more deep than theirs,

" I have

" I have made use of their name to denote the deepest and least reddish purples, " such as manifestly transcend their colour in purity.

" The *blue* of the first order, though very faint and little, may possibly be the " colour of some substances; and particularly the azure colour of the skies " seems to be of this order. For all vapours, when they begin to condense and " coalesce into small parcels, become first of that bigness, whereby such an azure " must be reflected, before they can constitute clouds of other colours. And so " this being the first colour, which vapours begin to reflect, it ought to be the " colour of the finest and most transparent skies, in which vapours are not ar- " rived to that grossness requisite to reflect other colours, as we find it is by ex- " perience.

" Whiteness, if it be intense, is either that in the first order of colours, of " which sort perhaps is the colour of white lead; or else it is a mixture of " those succeeding the third or fourth order, such as is the colour of paper, " linen, and most white substances. If corpuscles of various sizes, exhibiting the " colours of the second and third order, be mixed, they should rather constitute " an imperfect whiteness or grey, of which I have already spoken: but yet it seems " not impossible for them to exhibit an intense whiteness, if they be disposed to " transmit all the light, which they reflect not, and do not retain and stifle much " of it. For thus I told you, that froth at a distance hath appeared very white, " and yet, near at hand, the several bubbles, of which it was constituted, were " seen tinged all over with rings of colours of the four or five first orders.

" Lastly, for the production of *black*, the corpuscles must be less than any of " those, which exhibit colours. For at all greater sizes there is too much light re- " flected to constitute this colour. But if they be supposed a little less than is re- " quisite to reflect the blue of the first order, they will, according to the fourth, " eight, seventeenth, and eighteenth observations, reflect so very little light as " to appear intensely black, and yet may perhaps variously refract it to and fro " within themselves so long, until it happen to be stifled and lost; by which " means they will appear black in all positions of the eye without any transpa- " rency. And from hence may be understood, why fire, and the more subtil " dissolver, putrefaction, turn substances to black; why small quantities of black " substances impart their colour very freely and intensely to other substances, to " which they are applied; why glass ground very elaborately, on a copper-plate, " till it be well polished, makes the sand, together with what is worn off from " the glass, and copper, become very black; why black substances do soonest of " all others become hot and burn, which effect may proceed, partly from the " multitude of refractions in a little room, and partly from the easy commo- " tion of so very small corpuscles; and why blacks are usually a little inclined to " a bluish colour. For that they are so, may be seen by illuminating white " paper by reflection from black substances, which will usually appear of a bluish " white. And the reason is, that black borders on the obscure blue of the first " order, described in the eighteenth observation, whence the corpuscles of black " substances are most apt to reflect that colour.

" In

" In these descriptions I have been the more particular, because it is not impos-
" sible, but that microscopes may at length be improved to the discovery of
" corpuscles of bodies, on which their colours depend. For if those instruments
" could be so far improved, as with sufficient distinctness to represent objects five
" or six hundred times bigger than at a foot distance they appear to our naked eyes.
" I should hope, that we might be able to discover some of the greatest of those
" corpuscles. And by one, that would magnify three or four thousand times, per-
" haps they might all be discovered but those, which produce blackness. In the
" mean while, I see nothing material, that rationally can be doubted of, except-
" ing this position, that transparent corpuscles of the same thickness and density
" with a plate do exhibit the same colour. And this I would have understood
" not without some latitude, as well because those corpuscles may be of irregular
" figures, and many rays must be obliquely incident, and so have a shorter way
" through them than the length of their diameter; as because the straitness of
" the medium, pent in on all sides, may a little alter its motions, or other qua-
" lities, on which the reflexion depends. But yet I cannot much suspect the last,
" because I have observed of some small plates of Muscovy-glass, which were of
" an even thickness, that through a microscope they have appeared of the same
" colour at their edges and corners, where the included medium was terminated,
" which they appeared of in other places. However, it would add much to our
" satisfaction, if those corpuscles could be discovered with microscopes, which if
" we shall ever attain to, I fear it will be the utmost improvement of this sense;
" for it seems impossible to see the more secret and noble works of nature within
" those corpuscles, by reason of their transparency.

" This may suffice concerning the constitution of natural bodies, on which their
" colours depend. But for further understanding the nature of reflections, I
" shall add these two following propositions.

" Prop. 8. The cause of the reflection is not the impinging of light on the
" solid and impervious parts of bodies, as is commonly supposed.

" This will appear by the following considerations: first, that in the passage of
" light out of glass into air, there is a reflection as strong or stronger than in its
" passage out of air into glass, and by many degrees stronger than in its passage
" out of glass into water. And it seems not probable, that air should have more
" reflecting parts than water or glass. But if that should possibly be supposed, it
" will avail nothing; for the reflection is as strong, if not stronger, when the air
" is drawn away from the glass (suppose in the air-pump invented by Mr. Boyle)
" as when it is adjacent to it. Secondly, if light in its passage out of glass into
" air be incident more obliquely than at an angle of forty or forty-one degrees,
" it is wholly *reflected*; if less obliquely, it is in great measure *transmitted*. Now
" it is not to be imagined, that light at one degree of obliquity should meet with
" pores enough in the air to transmit the greater part of it, and at another degree
" of obliquity meet with nothing but parts to reflect it wholly; especially consi-
" dering, that in its passage out of air into glass, how oblique soever be its
" incidence, it finds pores enough in the glass to transmit the greatest part of it.
" If

" If any man suppose, that it is not reflected by the air, but by the utmost superficial parts of the glass, there is still the same difficulty; besides, that such " a supposition is unintelligible; and will also appear to be false, by applying water " behind some part of the glass instead of air. For so in a convenient obliquity of the rays, suppose of forty-five or forty-six degrees, at which they are " all *reflected*, where the air is adjacent to the glass, they shall be in great measure " *transmitted*, where the water is adjacent to it; which argues, that their reflection " or transmission depends on the constitution of the air and water behind the " glass, and not on the parts of the glass.

" Thirdly, if the colours made by a prism, placed at the entrance of a beam " of light into a darkened room, be successively cast on a second prism placed " at a great distance from the former, in such manner that they are all alike incident upon it; the second prism may be so inclined to the incident rays, that " those, which are of a blue colour, shall be all reflected by it; and yet those of a " red colour pretty copiously transmitted. Now if the reflection be caused by " the parts of air or glass, I would ask, why at the same obliquity of incidence " the blue should wholly impinge on those parts so as to be all reflected, and yet " the red find pores enough to be in great measure transmitted. Fourthly, " where two glasses touch one another, there is no sensible reflection, as was declared in the first observation; and yet I see no reason, why the rays should not " impinge on the parts of glass, when contiguous to another glass, a smuch as " when contiguous to air. Fifthly, when the top of a water-bubble (in the seventeenth observation) by the continual subsiding and exhaling of the water " grew very thin, there was such a little and almost insensible quantity of light " reflected from it, that it appeared intensely black; whereas, round about that " black spot, where the water was thicker, the reflection was so strong as to make " the water seem very white. Nor is it only at the least thickness of thin plates " or bubbles that there is no manifest reflection, but at many other thicknesses " continually greater and greater. For in the fifteenth observation, the rays of the " same colour were by turns transmitted at one thickness, and reflected at another " thickness, for an intermediate number of successions. And yet in the superficies of the third body, where it is of any one thickness, there are as many " parts for the rays to impinge on, as where it is of any other thickness.

" Lastly, if reflection were caused by the parts of reflecting bodies, it would " be impossible for thin plates or bubbles, at the same place to reflect the rays of " one colour, and transmit those of another, as they do according to the thirteenth " and fifteenth observations. For is is not to be imagined, that at one place the " rays, which, for instance, exhibit a blue colour, should have the fortune to dash " upon the *parts*, and those, which exhibit a red, to hit upon the pores of the " body; and then at another place, where the body is either a little thicker, or a " little thinner, that on the contrary the blue should hit upon its *pores*, and the " *red* upon its *parts*.

" Prop. 9. It is most probable, that the rays, which impinge on the solid " parts of any body, are not reflected but stifled and lost in that body.

" This

"This is consentaneous to the precedent proposition, and will further appear "by considering, that if all the rays should be reflected, which impinge on the internal parts of clear water or crystal, those substances should rather have a cloudy "than so very clear transparency.

"And further, there would be no principle of the obscurity or blackness, which "some bodies have in all positions of the eye. For to produce this effect, it is necessary, that many rays be retained and lost in the body, and it seems not probable, that any rays can be stopped and retained in it, which do not impinge on "its parts."

February 17. Mr. OLDENBURG produced and read divers experiments made in the air-pump at Paris, by Monf. HUYGENS and Monf. PAPIN, upon divers insects, and upon the lungs of animals: as also upon gun-powder, to find what quantity of air there is in that body, and to what degree it was compressed therein, &c.[e]

Of these experiments it was ordered, that the lungs of a lamb, newly killed, should be kept for the next meeting, and tried in the exhausting engine, after the manner observed by Monf. HUYGENS.

February 24. The experiment ordered for this meeting was tried, viz. the lungs of a lamb, after they had been put in water, and found to float, were blown up, and then put into the air-pump together with a gage; where, upon the first suctions, they swelled to a certain degree, and the air being well exhausted, so continued on, during the succeeding motions of the engine. Then the air being suddenly admitted again, the lungs presently contracted into a small bulk, and being taken out looked redder; and being thrown into water, sunk to the bottom. This was tried twice with the like success, though the second time they sunk not so deep as the first.

Monf. HUYGENS affirmed, that lungs having been put between two plates, with a considerable weight thereon, he had not been able so to express the air out of them, as to make them sink in water, though upon the exhausting of the air in the engine, and the admitting it again upon the lungs, they sunk.

The reason of this being enquired into by the members, Dr. CROUNE alledged, that the air, by its subtilty, was able to get every where equally to all the parts, inward and outward, of the lungs, and by an equal and universal pressure on them, lay flat and close all the vesicles thereof, which a weight laid only on the superficial parts of the lungs was not able to do.

It was ordered, that at the next meeting this experiment should be made of putting lungs between two plates, with a weight thereon, to see, whether it would not compress them so as to make them subside in water.

[e] These experiments are published in the Philosoph. Transf. vol. x. n° 122. p. 542.

Mr. OLDENBURG read a paper sent to him from Dr. ERASMUS BARTHOLIN, professor of mathematics at Copenhagen, containing the answers of a bishop of Iceland, named GISLAVUS THORLACUS, to several queries formerly sent thither by order of the Society [f].

" Ad Quæs. 1. Omnes liquores tenues, aquosi, & serosi, hic congelantur: me-" rus sanguis etiam congelatur, forsitan ob terrestrem sui partem majorem. Vi-" na quæ novimus dilutiora, hic quidem congelantur, sed fortiora vix id passura " puto; sic nec lixivia saponariorum fortia, nec spiritus mercurialis salium rec-" tificatos (ut vocant) neque sulphureos ex vino.

" De argento vivo frigori exposito num aliquam mutationem recipiat, non " satis compertum habeo, verisimile tamen est, aliquo modò condensari.

" Olea pura potius incrassari & condensari, quam in glaciem converti, ex-" istimo.

" Ad 2. Frigus terram ad sex vel septem pedum, aquam vero stagnantem ad " trium circiter pedum profunditatem, hic penetrare putatur.

" Ad 3. Horologiorum artificialium apud nos nullus est usus.

" Ad 4. Colores frigore summo concentrari posse, nullus dubito.

" Ad 5. De alteratione virium magnetis & succini per acre gelu nondum " compertum habeo.

" Ad 6. Omnia metallica & lapidea fragiliora redduntur ab acri gelu, & " tepefactione habent opus, quo redeant ad priorem naturam.

" Ad 7. Anatomicorum (qui nulli hic sunt) observationibus prorsus desti-" tuimur.

" Ad 8. Omnes grumi glaciales, qui ad hanc insulam ex Gronlandia vi ma-" ris & ventorum deferuntur, fiunt ex aqua dulci maris, & continuis accrementis " nivium, quorum nonnulli ad trecentarum ulnarum vel sexcentorum pedum al-" titudinem surgunt; tertia tantum parte supra aquam existente.

" Ad 9. Fontes in Islandia calidi reperiuntur quam plurimi, nullam gla-" ciem tolerantes, quorum nonnulli adeo fervent, ut omne munus ignis focalis " explere possint; puta tingendis pannis & coquendis cibis, etiam crassissimis, " ut carnibus, piscibus, &c.

" Ad 10. Figuram nivis non exacte observavi, grandinis autem figura fere " rotunda est, & granum piperis magnitudine sua rarius excedit.

[f] Letter-book, vol. vii. p. 182.

"Ad 11. Corpora quædam reservari posse nive, ut ova, crudas carnes, pisces
"recentes, &c. colore vel sapore non multum variante, non diffido, sed humefieri potius quam contrahi existimo.

"Ad 12. Circa fulgura, tonitrua, aliaque meteora, nihil notabile habeo, nisi "quod tonitrua etiam hyberno tempore hic nonnunquam exaudiantur, idque "in meridionali potissimum insulæ parte, ubi etiam terræ motus fiunt fortiores, "& frequentiores.

"Ad 13. Venti septentrionales apud nos frequentissimi sunt, & post hos "etiam meridionalis, cœteri autem rariores. Effecta autem eorumdem variant "juxta varium locorum situm; etenim occidentales venti, in occidentali Islandia "sunt aquosi, qui in orientali insulæ parte sunt sicci, & contra in orientali Islandia; orientales venti sunt humidi, in occidentali autem sicci. Eadem est ratio de septentrionalibus ventis in meridionali & septentrionali insulæ parte.

"Ad 14. Mons Hecla, qui annos jam quadraginta circiter siluit, neque "ignem vel flammam tanto temporis spatio emisit, nihil fere notabile habet, neque tempestatum mutationem præsagit, pumices potissimum suppeditat.

"Ad 15. Refractio in aere a nullo adhuc, quantum existimo, accurate observata est: diameter solis & lunæ longior hic apparet quam in Dania, & in "aliis meridionalibus regionibus. Pleiades quinque tantum stellas hic habet; "luna altero post conjunctionem die ut plurimum conspicitur.

"Ad 16. Ecclipsium observationem quantum poterimus pollicemur.

"Ad 17. Non adeo curiose notatum est hactenus, quanta copia salis ex coctione aquæ marinæ exire possit, cum a nullo, quod sciam, hic tentata sit, "nisi tantum a spectatissimo viro Gislavio Magni filio, qui tricesimam vel quadragesimam aquæ partem in salem converti existimat.

"Ad 18. De tempore autem æstuum marinorum, in diversis portubus, item "de altitudine, tempore, ac duratione, ejusdem æstus marini, ut & de mineralibus, "glebis, aliisque fossilibus his provenientibus (de quibus quæst. 18.) aliquod volente Deo, addam, postquam de his certius edoctus fuero.

"Ad. 19. Declinationem acus magneticæ, Nolæ, quæ sedes est episcopalis, "in Boreali Islandia observavi quindecim circiter graduum, latitudo ejusdem loci "est 66, 43.

"Ad 20. Ferrum ferruginem citissime hic contrahit, præsertim in meridionali "& maritima insulæ parte.

"Ad 21. De animalibus tam feris, quam domesticis videri potest disputatio M. Theodori Thorlacii de Islandia, Sect. 4. Thess. 6.

"Ad 22. Herbarum & fructicum plurimas species terra Islandica producit, "arborum autem præter betulam nullas.

"23. Jumenta cum ovium caprarumque grege tempore hyberno solo foeno "pascuntur, æstate autem gramine viridi.

"Ad 24. Colores animalium hic diversi sunt, sed frequentissimus est albus.

"Ad 25. Morbus præcipuus, quo laborant Islandi, est epidemicus, nostra "lingua (Landfarsootts) quo morbo laborantes capitis dolores cum pluritide præ-"cipue sentiunt.

"Ad 26. Plumæ, quas *ædardun* vulgo vocant, colliguntur ex nidis avium "quarumdam marinarum, quas *ædur* appellant Islandi, & plumulas tales a pro-"riis pectoribus avellunt: avis est ex anatum genere, anate major, sed minor "ansere.

"Ad 27. De monocerote marino (quod piscis genus hic admodum rarum est) "non nihil dictum est, quoad staturam & nomenclaturam, in dissertatione de "islandia. Thes. 6. Sect. 4."

Sir WILLIAM PETTY taking particular notice of the quantity of salt or brine, which in these answers was said to be contained in salt-water, and noting also what was said of the icy mountains being congealed only or mostly of fresh-water, suggested, that frost might serve to make strong brine, the fresh-water mingled with the salt-water being frozen, and successively taken off, and the remainder exposed again to freeze, till there remained nothing but a mere brine.

It was ordered, that a solemn letter of thanks should be returned to this bishop of Iceland, and that he be desired to favour the Society with an experimental answer to those queries, which in this paper were answered only from his conjectures.

March 2. Sir RICHARD EDGECOMBE was proposed candidate by Sir ROBERT REDDING.

Dr. CROUNE gave an account of the experiment ordered at the last meeting; which was, that though no lungs had been tried to be squeezed together with a weight, yet the operator had laboured to do it with both his hands as forcibly as he could, but had not been able thereby so to press out the air, as to make the lungs sink.

After this there was tried this experiment before the Society by Dr. CROUNE, viz. the lungs of a sucking rabbit were taken out by him as carefully as he could, and having ready a wide-mouthed glass filled with water, and a lead fastened to the lungs, he blew them up under the water, and stopped the quill, which was fastened in the trachea, with cement; and then being kept still under the water by the lead, the

6 lungs,

lungs, glafs, and all were put under a receiver, and fo the pump was plied: whereupon the lungs prefently expanded, and, as before, continued to do fo at a certain degree for fome time, a train of bubbles breaking out at firft, as it feemed, out of the fide of the lungs, yet without any hurt or wound on that fide. Afterwards they appeared to break out round about and every where out of the lungs. At length many bubbles rofe alfo from the bottom of the water; and withal a vaft number of very fmall bubbles continued to rife every where round the lungs, as if they fprung out of its natural pores. All this while the lungs in the water looked as white as any lungs do, that are blown up. Then letting in the air fuddenly, the lungs foon became much lefs in bulk, and prefently funk to the bottom, and when taken out appeared confiderably red.

Mr. HOOKE mentioned, that there had been lately with him a perfon, who had fuggefted to him fome new notions concerning the loadftone, viz. that the motions of it would vary and change far otherwife than hitherto had been taken notice of, fo as that the variation of it would be for a quarter of a year to the eaft, and the next quarter to the weft of the north; and particularly that the twenty-ninth of February preceding it would be four degrees to the eaftward. Mr. HOOKE added, that he intended to obferve it, having already made a meridian for that purpofe, and to give the Society an account of the refult of his obfervations.

Mr. OLDENBURG moving, that now the fun and feafon being likely to ferve for the making of Mr. NEWTON's experiment called in queftion by Mr. LINUS, an apparatus might be prepared for that purpofe; Mr. HOOKE faid, that he had an apparatus ready to make the experiment, when the Society fhould call for it.

March 6. At a meeting of the COUNCIL were prefent

The lord vifcount BROUNCKER, prefident,

The lord bifhop of Chefter,	Mr. HENSHAW,
Mr. fecretary WILLIAMSON,	Mr. COLWALL,
Sir PAUL NEILE,	Mr. MILLES,
Sir JOHN BANKES,	Dr. CROUNE,
Sir CYRIL WYCHE,	Dr. GREW,
Sir ROBERT SOUTHWELL,	Mr. HILL,
Dr. HOLDER,	Mr. OLDENBURG.
Dr. PELL,	

The prefident moved, that it might be confidered how to provide for the weekly meetings of the Society a fufficient number of experiments to be made from time to time, and to pitch upon fuch perfons, as might be depended upon for the exhibiting of them.

After fome debate it was ordered, that Sir JOHN BANKES, Sir CYRIL WYCHE, Sir JONAS MOORE, Mr. COLWALL, Dr. CROUNE, Dr. GREW, Mr. HILL, or any three or more of them (whereof the treafurer, Mr. COLWALL, to be one) and as many

many more of the council, as ſhould pleaſe to join themſelves with them, be a committee for conſidering of perſons, members of the Royal Society, fit to entertain the ſaid Society at their weekly meetings from time to time with experiments, and diſcourſes upon them, to be left in writing, in order to be regiſtered: and having found ſuch perſons, as were able, and would engage in this work, to offer to them for every ſuch experimental exerciſe performed before the Society, and delivered in writing, a ſum of money not exceeding the value of four pounds, beſides the charges requiſite to make the reſpective experiments: and this committee to meet in the Society's repoſitory on Thurſdays, at three o'clock preciſely, and to make a report of their progreſs in this matter to the council.

A propoſal concerning Chelſea College was made by Mr. Oldenburg from a perſon, who would not yet be named, deſiring a leaſe of the houſe and land then in poſſeſſion for thirty-one years, at thirty pounds *per annum*, or for fifty years at thirty-five pounds *per annum*, and in both caſes to make the houſe tenantable with all convenient ſpeed.

The council declared hereupon, that it was a fair propoſition to treat upon; and that they would appoint a committee to do ſo, when they ſhould underſtand, that the propoſer was returned from Cambridge, whither, they were informed, he was gone.

Some of the council moved, in the mean while, that the propoſer might be obliged not to put the houſe to any other uſe than had been now named by Mr. Oldenburg, which was to practiſe chemical operations, to make a phyſic-garden, and a repoſitory for natural curioſities, without obtaining leave from the council: otherwiſe the leaſe to be void.

There was then read a propoſal for encouraging the preſs of Oxford, recommended by Sir Joseph Williamson, ſecretary of ſtate, to the council, viz. to fix upon ſome good book or books to be printed there at a reaſonable rate, at ſuch time as five hundred ſubſcribers ſhould be obtained.

The council declared, that they would conſider of ſome books to be printed accordingly, and thereupon offer and recommend the paper produced to particular perſons of their number for ſubſcriptions, and to do the like to the body of the Society.

After this, the committee for managing the repoſitory of the Society made a report to the council of what they had done in that affair, viz. that they had removed the particulars thereof out of the rooms, where they had hitherto been, into the gallery at the weſt end of Greſham College, and there ranged them in order: and that it now remained only for the council to order an inventory or catalogue to be made both of thoſe curioſities and the books, and to appoint perſons to have the cuſtody of the ſame.

Whereupon it was ordered, that Sir John Bankes, Sir Cyril Wyche, Sir

JONAS MOORE, Mr. MILLES, Mr. DANIEL COLWALL, Dr. CROUNE, Dr. GREW, Mr. HILL, or any or more of them (whereof Mr. COLWALL to be one) be a committee for considering of persons, who might be fit to make an inventory or catalogue, not only of the natural curiosities and books of the Royal Society, but also of all the goods and chattels belonging to the same, and to cause all those particulars to be entered in a book: and likewise to fix upon a trusty person to be keeper of all the things above-mentioned, and to represent the result of all to the council.

The treasurer moving, that for the future he might not pay any salary to the respective officers of the Society without an order from the president, it was ordered,

That for the future, the treasurer, do not pay any salary to any officers of the Society without an order from the president.

Mr. HENSHAW desiring to borrow for the use of some learned friends of his out of the Arundelian library given to the Society, the MS. of St. CYPRIAN, for the restoring of which he would engage himself by a note under his hand; it was ordered, that Mr. HOOKE should deliver to him, as soon as conveniently he could, the said MS. Mr. HENSHAW giving to Mr. OLDENBURG a note under his hand to restore it safe and undamnified, within the space of six months from the date hereof: and that this order be signed by the president.

N° 122. of the *Philosophical Transactions* was licensed.

March 9. At a meeting of the SOCIETY,

An experiment was made, upon Mr. BOYLE's suggestion, with a bolt-head glass sealed up hermetically, put in water and in a receiver in the engine, to see whether the bubbles, which at the last meeting were seen to rise very copiously and presently about the lungs, would do the like about the glass. It was found, that they rose about it very soon after the pump was begun to be plied, and in good numbers, yet not so great by far, as they did about the lungs. And here the bubbles settled themselves copiously upon the glass round about it, but by little and little broke off from it.

Mr. OLDENBURG produced a paper, sent to him in a letter from Sir PHILIP SKIPPON, being a relation of Virginia, and containing a short natural history of that country [g], viz. the geography of it, a description of the rivers there, together with the several sorts of fishes, which they afford; as also of the mountains of Virginia, and the attempts made to discover, whether on the back of them were any rivers running into the South Sea: likewise of the mines, soil, herbs, timber, and fruit-trees, cattle, deer, wild beasts: and, lastly, of the Indian

[g] It was drawn up by Mr. THOMAS GLOVER, a chirurgeon; and is printed in the Philosoph. Transf. vol. xi. n° 126. p. 623. for June, 1676.

inhabi-

inhabitants themselves, their small numbers, their way of cloathing, building, hunting, fishing, divine worship, money, diseases, way of physic, and manner of planting and ordering tobacco.

March 16. There was read a large letter to Mr. OLDENBURG from Mr. FRANCIS VERNON, dated at Smyrna, 10th January, $167\frac{5}{6}$, giving a summary account of the observations made by him in his travels from Venice through Istria, Dalmatia, Achaia, Morea, and the Archipelago to Smyrna [h], and taking notice of Monf. De la GUILLIETIERE's description of Athens, as containing many mistakes and falsities, though plausibly written.

Divers members expressed their desires, that this letter of Mr. VERNON might be printed.

Occasion being given of discoursing about the cause of the ascent and descent of the spirit of wine in sealed thermometers, and that being ascribed by some of the members to particles of air interspersed in the liquor, it was ordered, that at the next meeting some spirit of wine should be put into the air-pump, and the air of it exhausted, and thereupon such purged spirit be presently sealed up in a fit and well-wrought glass-cane, and another such cane of the same size and shape every way be ready to be filled with spirit of wine unexhausted, in order to see the manner and difference of their working together.

It was ordered also, that Mr. NEWTON's experiment, questioned by Mr. LINUS, should be made at the next meeting, if the weather should prove favourable for it.

Mr. OLDENBURG presented to the Society his tenth volume of the *Philosophical Transactions* for the year 1675.

March 23. There was no meeting of the Society.

1676, *March* 30. There was no meeting of the Society on account of the Easter holy-days.

April 6. Mr. OLDENBURG delivered the box formerly sent to the Society by Dr. SWAMMERDAM, containing an uterus, and the neighbouring parts thereof, so prepared with wax syringed into the vessels thereof, that the parts of their connection might be distinctly seen; together with the arteries and veins of a human spleen and those of a calf, part of the *intestini jejuni valvulæ conniventas*, part of the *portiuncula* of a *penis & urethra*, and a *lymphaticum peculiare ex abdomine gallinæ:* besides, upon a paper delineated, the *arteria primi generis seu pulmonalis in piscibus, per quam sanguis ad branchias amandatur*, and the *arteria secundi generis in piscibus, per quam sanguis e ramis branchialibus immediate per eorum corpus distribuitur.*

[h] It is printed in the Philosoph. Transact. vol. xi. n° 124. p. 575. for April, 1676.

Mr.

Mr. Oldenburg read a letter to himself from Mr. Hevelius, dated at Dantzick, 11th March, 167$\frac{5}{6}$, complaining of the animadversions made by Mr. Hooke upon his *Machina cœlestis*, and intimating his resolution to answer them; sending also an observation of his of a phænomenon of Saturn made 14th August, 1675. wherein the body of that planet appeared beneath the ring; together with his observation of the solar eclipse of 23d June, 1675 [i].

A committee, consisting of Sir Jonas Moore, Dr. Croune, Mr. Hill, Dr. Grew, and Mr. Hooke, was appointed to try Mr. Newton's experiment controverted by Mr. Linus; and it was ordered, that after the trial of it by that committee, it should be made before the Society.

April 13. There was read a letter in Latin from Signor Travagino, dated at Venice, 24th March, 167$\frac{5}{6}$, addressed to the Society, returning them thanks for his election into their body.

Dr. Grew presented the Society with an experimental discourse, in pursuance of one part of his former lecture, concerning mixture, such a branch of philosophy, as might give great light into the nature of bodies. The design of this discourse, and the experiments attending it, was to observe the luctation, that arises from the mixture of several liquors with vegetable, mineral, and animal substances; the author undertaking in that discourse vegetables and minerals, and reserving animal substances for another time, and distinguishing the several ways and effects of this luctation, viz. ebullition, elevation, crepitation, effervescence, and exhalation. The liquors employed were eight or nine, viz. spirit of sal armoniac, spirit of hart's-horn, spirit of scurvy-grass, spirit of wine, spirit of nitre, spirit of salt, oil of sulphur, oil of vitriol, aquafortis. The materials, upon which these liquors were infused, were about an hundred.

It was desired, that this discourse might be registered [k], and, when finished, printed [l].

April 27. The experiment of Mr. Newton, which had been contested by Mr. Linus and his fellows at Liege, was tried before the Society, according to Mr. Newton's directions, and succeeded, as he all along had asserted it would do: and it was ordered, that Mr. Oldenburg should signify this success to those of Liege, who had formerly certified, that if the experiment were made before the Society, and succeeded according to Mr. Newton's assertions, they would acquiesce, as appears by Mr. Gascoigne's letter to Mr. Oldenburg of 15th December, 1675.

The experiment was thus: a prism was taken, and so held, that its axis was perpendicular to the sun's rays (it being a very clear sun-shine day) and in this

[i] Both these observations are printed in the Philosoph. Transact. vol. xi. n° 127. p. 660, 661, for July, 1676.

[k] Register, vol. v. p. 186.

[l] It is printed in his Anatomy of Plants, lecture 2. p. 238.

posture it was placed in a darkened room, as close as might be to the hole, through which the sun shined into the dark room; which hole was about the bigness of a pea. Then the prism was turned slowly about its axis, and the colours were seen to move upon the opposite wall, first towards that place, to which the sun's direct light would pass, if the prism were taken away; and then back again. When the colours were about the middle of these two contrary positions, that is, when they were nearest to that place, to which the sun's direct rays tended, there the experimenter stopped, the rays being then equally refracted on both sides the prism. In this posture of the prism, the figure of the colours being observed, it was found not round, as Mr. LINUS contended, but oblong; the colours red, yellow, green, blue, purple, succeeding in order, not from one side of the figure to the other, as in Mr. LINUS's conjecture, but from one end to the other, and the length of the figure being not parallel, but transverse to the axis of the prism.

Dr. CROUNE gave an account of the experiment of exhausting the air out of spirit of wine, and of comparing it then with such spirit unexhausted, to see the difference of its working in sealed thermometers. He said, that that spirit thus exhausted was more sluggish by a fourth part than that, which was not exhausted.

The president ordered, that it might be tried again before him, being of opinion, that the difference of the working would be greater, if the air were more exhausted.

Dr. CROUNE took notice of an experiment made and published by Monf. HUYGENS, in 1672, viz. whether the effect of a syphon of unequal legs, by which the water of a vessel is made to run over, is ascribed to the weight of the air pressing upon the water in the vessel. He, Monf. HUYGENS, made the water of the syphon run, after the recipient was exhausted of air; and found also, that with water purged of air it produced the like effect as well as without the recipient; he affirming withal, that the recipient was well exhausted of air, he having assured himself of that, as well by finding, that there came not more air through the pump, and by other more sure marks: which experiment he took for a confirmation of his opinion, that there is, besides the air, a pressing matter more subtil than the air.

Mr. HOOKE hereupon affirmed, that he could do the same with quicksilver, and make it run out of a syphon after the air was well exhausted.

The president desired to see that experiment.

Mr. OLDENBURG presented the Society with a manuscript of Monf. JOLY of Dijon, containing a body of mechanics, in which he pretended to have found and demonstrated an universal principle to explain the effects of the moving powers in engines, desiring the Society's judgment thereof. Upon which the president, Sir CHRISTOPHER WREN, Sir JONAS MOORE, Dr. WALLIS, Dr. PELL, Dr. CROUNE,

CROUNE, and Mr. HOOKE, were desired to read it over, and consider it, and make a report to the Society.

The president informed the Society, that a bitch of his, that was unspleened some years ago, had been opened the other day; and nothing of any succedaneum found in the place of the spleen.

May 4. being Ascension-day, the Society did not meet.

May 11. There was made before the Society by WILLIAM COLE, M. D. an observation about the intestines of animals, viz. that the structure of their fibres is not annular, as had been before generally received, but spiral.

The observation was shewn in the colon of a sheep, and the discoverer's written account thereof [m] read. But because the meeting was very thin, and neither the president nor vice-president in the chair, it was thought proper to repeat both the observation and discourse at a fuller meeting for farther examination; the author being desirous to have the judgment of the Society upon both.

May 18. Mr. HALL was admitted fellow.

Dr. GREW produced an account of a woman breeding stones in great quantities of different sorts, and voiding them, partly by vomit, partly by the urinary passages; some great, some little, whereof the little ones looked like small white pebbles; others friable like gritty stones, and of the colour of fullers earth.

He remarked, that having poured spirit of nitre upon both sorts of these stones, he found, that it wrought upon the greater stones, but not upon the pebbles: whence he conjectured, that since it was not likely, that in one and the same body should be bred stones of so different natures, as all other stones observed by him make an effervescence with some acid or other; it might be, that this woman by an irregular appetite had chewed and eaten one sort of these stones, which afterwards by some viscous matter were concreted together in the body; by virtue of which viscous matter mixed with the stones alone it was, that those stones thus concreted made the said effervescence.

Mr. OLDENBURG produced several papers communicated to him; one from Dr. BEAL, containing two instances of something remarkable in shining flesh [n]: the second from Monf. LEIBNITZ, concerning sparks seen in an old baroscope upon agitation: the third from Dr. COLE, concerning the spiral, instead of the hitherto supposed annular structure of the fibres of the intestines.

As to the first, it being mentioned, that a warm and moist air might contribute to the production of such a phænomenon, the president said, that since we were

[m] It is printed in the Philosoph Transact. vol. xi. n° 125. p. 603. for May, 1676.

[n] This paper is printed in the Philos. Transact. vol. xi. n° 125. p. 599.

masters of such a cause, it were worth trying, whether such a phænomenon could be raised from it.

As to the second, the president intimated, that he would exhaust all the air out of the mercury, and make a mercurial tube stand top-full, and then make it fall down, and so observe, whether any such light appeared.

For the third, the operator was ordered to boil the colon of a sheep's gut on the Thursday following four hours immediately preceding the Society's meeting, that so it might be produced there for making the observation of Dr. COLE.

Mr. AUBREY acquainted the Society, that he had received from Sir FRANCIS ROLLE some manuscripts of Mr. FOSTER [o], for their perusal. It was only desired, that the Society would give assurance to see them returned, when they had done with them, to Mr. OVERTON, from whom they had been obtained by the sollicitation of Mr. ANDREW PASCALL, rector of Chedsey in Somersetshire.

Hereupon the Society ordered, that Mr. COLLINS should be desired to peruse these manuscripts, and make a report of them to the Society: and that they should be faithfully returned to Mr. OVERTON, as soon as the Society had done with them.

The titles of the MSS. as taken out of Mr. PASCALL's letter to Mr. AUBREY, dated at Chedsey, 7th April, 1676, were as follows:

1. *Motuum & eclipsium solis & lunæ computatio trigonometrica juxta hypotheses Lansbergii ad commodiorem calculi formam reducta; cui præfigitur problematum etiam primi motus (quæ ad eclipses spectant) solutio.*

2. *Kepleri præceptum* 25 *illustratum, demonstratum, refutatum.*

3. A general instrument described, and the use declared in the working of proportions of eight several kinds, i. e. of, 1. Numbers or equal parts. 2. Equal parts and superficies. 3. Equal parts and solids. 4. Equal parts and tangents. 5. Sines with sines. 6. Sines with versed sines. 7. Sines with equal lines. 8. Sines with tangents.

4. A lecture about the sun's motion; *delineatio Procli de* * *

5. *Explicationes in tabularum Rudolphinarum capita quatuordecim.*

6. *Horologiorum sciatericorum descriptiones variæ.*

7. *Ad commentarios sectoris & radii, ut & eminentissimarum propositionum paralipomena.*

[o] Mr. SAMUEL FOSTER, professor of astronomy in Gresham college, who died in July, 1652. Dr. WARD's Lives of the Professors of Gresham College, p. 85.

8. Part of Mr. GUNTER's book explained, of the sector.

9. The first book of geometry of problems, in the structure whereof only circles and right lines are used.

10. The second book of geometry, of the nature of crooked lines: and the third of the construction of problems, that are solid.

The president nominated and appointed the lord bishop of Chester, Sir JONAS MOORE, Dr. JOHN PELL, and Dr. WALTER NEEDHAM to be vice-presidents of the Society.

June 1. Sir THOMAS CLUTTERBUCK was proposed candidate by Mr. OLDENBURG.

Mr. SMETHWICK gave an account of the sun's eclipse observed by him that morning, as follows [p]:

Initium defectionis Westmonasterii - - - - -	*h.* 7 50′	*Post mediam noctem*
Finis - - - - - - - - - -	9 $54\frac{3}{4}$	*Junii* 1, 1676.

Totius eclipsis duratio horæ 2 $4'\frac{3}{4}$.

The observation was made by a second pendulum corrected by two days observations, and a tube of seven feet and a half.

According to this observation the eclipse began sooner by 4′, and ended sooner by 8′, than Mr. FLAMSTEAD had predicted in the Royal Almanack.

It was ordered that Mr. FLAMSTEAD's and Mr. STREET's observations should be inquired after.

One Mr. BOWLAND, who had lived at Tangier for six or seven years, shewed the Society some observations about the tides and current of the Straits, viz. that there is in the Straits mouth not only a current, but also a constant flux and reflux following the motion of the moon, concerning which he promised to give the Society his particular observations proving the matter of fact.

Mr. OLDENBURG read a letter written to him from Dublin, dated 10th May, 1676, by Mr. HENRY NICHOLSON, relating [q] a strange effect of thunder upon a magnetic sea-card, whose north and south points had changed positions in such a manner, that though the master of the ship had with his finger brought the flower de lys to point directly north, it would as soon as at liberty return to the new unusual posture. Besides, upon examination it was found, that every compass in the ship was of the same humour. Capt. GROFTON of New England

[p] It is printed in the Philosoph. Transact. vol. xi. n° 126. p. 637.

[q] It is printed in the Philos. Transact. vol. xi. n° 127. p. 647.

was

was ſaid to be the maſter of the ſhip, to which this accident happened; and Mr. HOWARD, maſter of ſeveral ſhips, and a man of good credit, was the relater of this accident.

It was ordered, that theſe perſons be inquired after and examined concerning the truth of this relation.

Dr. GREW entertained the Society with his diſcourſe concerning the operation of ſpirit of nitre and oil of vitriol upon animal bodies, both of the exterior and interior parts of them. The exterior were hairs, nails, hoofs, and horns, ſhells, ſhelly inſects, teeth and other bones, fleſh, and all the viſcera, blood, muſk, civet, ſperma ceti, gall, wine, ſalt of blood, of hartſhorn, of wine, tartar of wine, ſtones, as of the bladder, of the gall, bezoar, weſtern and oriental, of ſtones extraordinary voided by a woman in Hereford.

He was thanked for his diſcourſe, and deſired to give it to be entered [r] and printed [s] with his former diſcourſe.

June 8. Three letters were read,

1. Written at Liege, 27th May, 1676, by Mr. LUCAS, ſucceſſor in the mathematical profeſſorſhip there to Mr. ANTHONY LINUS, containing partly an account of the ſucceſs of Mr. NEWTON's experiment there; partly ſome new objections againſt Mr. NEWTON's theory of light and colours [t].

This letter was ordered to be copied, and the copy to be immediately ſent to Mr. NEWTON at Cambridge for his anſwer thereto.

2. A letter from Mr. BOUCHIER to Mr. EDMUND HALLEY from Jamaica, 10th March, 167$\frac{5}{6}$, communicated by the latter to Mr. OLDENBURG, giving an account of divers remarkable particulars in that iſland, its ſalubrity, productions, and fitneſs for aſtronomical obſervations, there being ſcarce two cloudy nights in a whole year.

3. A letter from Mr. HENRY NICHOLSON, dated at Dublin, 20th May, 1676, relating a ſtrange effect of thunder upon a magnetic ſea-card, its north and ſouth points having changed poſitions irrecoverably; and containing likewiſe ſome obſervations about the alteration of the temperature of Ireland and other countries; as alſo the contrivance of an hygroſcope; together with an experiment propoſed for diſcovering the uſe of reſpiration; and ſome obſervations concerning the American flying hart, and the ſtrong muſky ſcent of the animal called muſk-quaſh [u].

There was alſo read Mr. COLSON's obſervation of the late ſolar eclipſe of June 1, made at Wapping [x].

[r] Regiſter, vol. v. p. 147.

[s] It is printed in his *Anatomy of Plants*, p. 242.

[t] This letter is printed in the Philoſ. Tranſact. vol. xi. n° 128. p. 692.

[u] This letter is printed in the Philoſ. Tranſact. n° 127. p. 647 & ſeqq.

[x] Ibid. n° 126. p. 637.

June

June 15. There were read two letters, the one written by Mr. HENRY HALL to Mr. OLDENBURG out of Gloucestershire, giving an account of the iron and coal mines in the forest of Dean.

The other letter was from Mr. NEWTON, dated at Cambridge, 13th June, 1676, containing partly a general answer to Mr. LUCAS's letter [y], with a promise of a particular one; partly some communications of an algebraical nature for Monf. LEIBNITZ, who by an express letter to Mr. OLDENBURG had desired them [z].

July 18. At a meeting of the COUNCIL were present

Sir JONAS MOORE, vice-president, in the chair,
Sir ROBERT SOUTHWELL, Mr. COLWALL,
Dr. CROUNE, Mr. OLDENBURG.

It was ordered, that n° 127 of the *Philosophical Transactions* with two tables of cuts be printed by the printer of the Society.

October 3. At a meeting of the COUNCIL were present

The lord viscount BROUNCKER, president,
Sir JONAS MOORE, Dr. GREW,
Dr. HOLDER, Mr. MILLES,
Mr. COLWALL, Mr. OLDENBURG.

It was ordered, that n° 128 of the *Philosophical Transactions* with two tables of cuts be printed by the Society's printer.

The president was put in mind of giving order for summoning the Society to meet again; which his lordship said he would do on the first Thursday in the approaching term, October 26.

October 12. At a meeting of the COUNCIL were present

The lord viscount BROUNCKER, president,
Sir PAUL NEILE, Mr. COLWALL,
Dr. PELL, Mr. HILL,
Dr. CROUNE, Mr. OLDENBURG.
Dr. GREW,

It was ordered, that the Society's printer, Mr. MARTYN, be required to give notice in the *Philosophical Transactions* next to be printed, of what the council was

[y] See Philosoph. Transact. vol. xi. n° 128. p. 698.

[z]. This part of Mr. NEWTON's letter was sent to Mr. LEIBNITZ at Paris, 26th June, 1676, together with a MS. of Mr. COLLINS, containing extracts of Mr. JAMES GREGORY. See *Commercium Epistolicum*.

informed

informed he had declared, viz. that the tract called *Lampas* [a], made by R. HOOKE, fellow of the Royal Society, and lately printed by JOHN MARTYN, printer to the said Society, to which is annexed *a postscript*, reflecting on the publisher of the *Transactions* [b], was printed without the leave or knowledge of the council of

[a] It was printed in 4to, and intitled *Lampas: or Descriptions of some mechanical Improvements of Lamps and Waterpoises. Together with some other physical and mechanical Discoveries. With a Postscript in reply to* Mr. OLDENBURG.

[b] The dispute between Mr. HOOKE and Mr. OLDENBURG began on the following occasion: Mr. HOOKE, soon after the restoration, shewed the movement of a watch, regulated by a spiral spring applied to the arbor of the balance, and designed for discovering the longitude, to some of his friends, through whose interest in the year 1663 he might have had a patent for the invention; but not liking the conditions, the matter was laid aside. The year following he read several of his Cutlerian lectures upon that subject in the reading-hall at Gresham College, and caused several of the said watches to be made. [See his Life by Mr. WALLER prefixed to his *posthumous works*, p. 5.] Some account of this invention was afterwards given in the *History of the Royal Society*, p. 247, (though not so full as Mr. HOOKE could have wished) where among other inventions, are recounted "several new kinds of pendulum "watches for the pocket, wherein the motion is "regulated by springs." Thus continued the affair till Monf. HUYGENS sent a letter to Mr. OLDENBURG, dated 30th January, 167 4/5, N. S. acquainting them with an invention of his of very exact pocket watches, the nature and contrivance of which he imparted to Mr. OLDENBURG in an anagram, which in a subsequent letter, of 20th February, N. S. he explained by a full description; for which the Royal Society returned him thanks on the 18th of that month, O. S. at which time Mr. HOOKE said, that divers years before he had such an invention, and that actually watches had been made according to the same; for which he appealed to the Journal Books of the Royal Society, to the *History of the Society*, and to several members. Upon which the Society ordered, that Monf. HUYGENS should be informed, what had been done here; and what were the causes of its want of success. Not long after came over from Paris in the *Journal des Sçavans*, for 25 February, 167 4/5, a printed description of Monf. HUYGENS's invention, with a delineation of its figure; an extract of which *Journal* was printed 12th March following, in the *Philosophical Transactions*, vol. xi. nº 112. p. 272. This gave offence to Mr. HOOKE, who in a *postscript* to his *Description of Helioscopes*, printed in 1675, complained of Mr. OLDENBURG, the publisher of the extract, for omitting to take notice, that "this in-"vention was first found out by an Englishman, "and long since published to the world;" and he called this *unhandsome proceedings*. And at the same time he said, that as to the models, which he had yet produced, he was unwilling to add any of the better applications of the springs to them, waiting for an opportunity more to his advantage. Mr. OLDENBURG answered to this in the *Philosoph. Transact.* nº 118. p. 440. for October, 1675, that Mr. HOOKE both saw and copied the figure of Monf. HUYGENS's watch before the extract of the *Journal des Sçavans* was made. And as he knew that both would be published in one of the *Transactions*, had he given to the editor of them the least intimation, that he desired, that notice might be taken at the same time of his invention of the like kind, it would have certainly been done, as it had been before on other occasions. But Mr. OLDENBURG seeming to resent it, that he should be charged with *unhandsome proceedings* on this account, in return he said, that "though Mr. HOOKE had "some years before caused some watches to "be made of this kind, yet without publish-"ing to the world a description of them *in print*; "and it is certain, that none of those watches "*succeeded*." In reply to this, Mr. HOOKE in the *postscript* to his *Lampas*, blamed Mr. OLDENBURG for affirming "what he could not know with re-"gard to the *success* of his watches, whom, as he "said, he had not acquainted with his inven-"tions, since he looked on him as one, who "made *a trade of intelligence*." And as to his not having himself published them to the world *in print*, he said, "they were publicly read of in "Sir JOHN CUTLER's lectures, shewn to thousands "both English and foreigners, written of to several "persons absent, and published *in print* in the "*History of the Royal Society*." Whether Mr. HOOKE's watches were *unsuccessful* or not, Mr. WALLER says, (Life of Dr. HOOKE, p. 7.) he "could not learn, but was inclined to think that "expression of Mr. OLDENBURG proceeded from "passion, the invention and principle of Mr. "HOOKE's and Monf. HUYGENS's being both "the very same, as are now used." Mr. OLDENBURG took no farther notice of this reply of Mr. HOOKE than to publish the following *advertisement* at the end of the *Transaction* for August and September, 1676. "The publisher of this tract in-"tends to take another opportunity of justifying "himself

of the Royal Society, and that the said printer had seen nothing of the postscript thereof before it was printed off, nor knew any ground for the aspersions contained therein: and in case the said printer should refuse to obey this order, that then the new printer, whom the president hath power to constitute in his room, be required to signify to the public in print, that Mr. MARTYN was removed for disobeying this order of the council.

It was ordered, that Mr. COLWALL and the secretary do prepare for the next meeting of the council a list of those, who had not yet sealed the bond, nor paid their weekly contributions.

October 26. The SOCIETY resumed their weekly meetings.

Dr. GREW made a discourse on the anatomy of some roots of vegetables and of their leaves [c], exhibiting at the same time very curious figures of what he had thus discoursed of.

The Society was very well pleased with his performance, and declared the discourse and the schemes very well worth the publishing [d].

Mr. OLDENBURG presented to the Society from Mr. BOYLE his new book, intitled, *Experiments, Notes, &c. about the mechanical Origin of divers particular Qualities: among which is inserted a Discourse of the Imperfection of the Chemists Doctrine of Qualities: together with some Reflections upon the Hypothesis of* Alkali *and* Acidum.

The president remarked, that having read this book of Mr. BOYLE, he thought it very well worth the reading of philosophical men.

November 2. At a meeting of the COUNCIL were present

The lord viscount BROUNCKER, president,

Sir JONAS MOORE,	Dr. CROUNE,
Mr. HILL,	Mr. COLWALL,
Dr. HOLDER,	Mr. OLDENBURG.

Upon the debate concerning a scandalous *postscript* annexed to a book called *Lampas*, it was ordered, that it be referred to Dr. CROUNE and Mr. HILL, to present a draught to the council of what they conceived might be fit for the council to publish in the next *Transaction* in behalf of Mr. OLDENBURG's integrity and faithfulness to the Royal Society.

" himself against the aspersions and calumnies of " an immoral postscript put to a book called *Lampas*, published by R. HOOKE, till which time, " it is hoped, the candid reader will suspend his " judgment."

[c] This discourse on the anatomy of leaves is entered in the Register, vol. v. p. 157.

[d] They are printed in his *Anatomy of Plants*, B. 4. p. 145. & *seqq.*

At the fame time leave was given to Mr. OLDENBURG to print that part of Monf. HUYGENS's letter to him, 20th February, 167⅘, which devolves on the Royal Society his right of defiring in England a patent for his watches [e].

Mr. HENRY HUNT being propofed to fucceed in Mr. SHORTGRAVE's place, the council having heard the feveral good teftimonies given him of his abilities and honefty, received him to be operator to the Society, *quamdiu fe bene gefferit*; and he was fworn at the fame time.

At a meeting of the SOCIETY on the fame day,

Mr. OLDENBURG read a letter of Dr. LUCAS HODGSON, a practitioner of phyfic at Newcaftle, dated there, 15th May, 1676, giving an anfwer to feveral queries formerly fent to him by Mr. BOYLE concerning the fubterranneal fire, that had been burning in a coal-mine very many years near Newcaftle [f]: which letter was accompanied with a box, containing fome of the fal armoniac, as it was gathered there from fire; together with fome of the fpirit of that fal armoniac diftilled from quick lime; as alfo fome white falts fublimed from the faid natural falt.

Mr. HOOKE mentioned a new fanative fpring lately difcovered in Staffordfhire, healing divers difeafes, as the dropfy, fcurvy, &c. adding, that a book was printed concerning it.

It was ordered, that the lord BRERETON fhould be written to by Mr. OLDENBURG, and defired from the Society to perufe the faid book, and give them an account how far the real effects anfwered the particulars mentioned in it: as alfo to learn henceforward what kind of perfons repair to thofe waters, and what effects they have upon them.

Mr. OLDENBURG prefented from Sir ROBERT SOUTHWELL for the repofitory a paper of gold fand brought over by him from Portugal, and taken out of a river near Coimbra, having yielded fome fmall grains of good gold.

Mr. OLDENBURG read a paper fent to him from Paris about an odd kind of grain, called by the writer corrupted rye, growing in certain years in feveral provinces of France, and being fo corrupted, that thofe, who eat of the bread having much of this grain in it, are feized by a gangrene in one part or another, the gangrene not being preceded by any tumour, inflammation, or confiderable pain, and the gangrened parts falling off of themfelves fo as that there is no need to feparate them by any remedies or inftruments: and it being given to feveral animals, they died [g]. Some members thought, that it was very well worth making a chemical analyfis of this corrupted rye, and to compare it with the like chemical refolution of good rye. Others fuggefted, that fome good rye might be

[e] Mr. OLDENBURG publifhed that part of Monf. HUYGENS's letter in the Philof. Tranfact. vol. xi. n° 129. p. 749.

[f] This letter is printed, n° 130. p. 762.

[g] This account is printed in the Philofoph. Tranfact. n° 130. p. 758.

be planted in the ground, where this corrupted rye uses most to grow, in order to see how that would prove.

November 9. Mr. CHARLES HOWARD produced a parcel of wheat grown here of wheat brought from Tangier.

He produced also some red-streak and red red-streak apples, grown at Darking, of some of the grafts, which formerly were distributed by the Society, to whom they had been sent by Mr. REED out of Herefordshire.

Dr. GREW read a discourse concerning flowers, accompanied with many elegant and curious schemes in presenting the particulars discoursed of [h].

He had the applause of the Society, who declared the discourse and figures very well worth publishing [i].

Mr. BALLE brought in two pieces of amber, sent from Capt. SILAS TAYLOR to the Society for their repository, and said by him to have been taken up in Suffolk at Tangirsford, not far from Harwich.

November 16. Mr. OLDENBURG read a long letter to himself from Mr. JOHN BEAUMONT, junior, of Stony Easton in Somersetshire, dated 17th June, 1676, containing a discourse about rock-plants and their vegetation, together with an account of those various figures, that are found among minerals [k].

Mr. OLDENBURG read likewise a letter to himself, dated 9th July, 1676, from Mr. LISTER, concerning the black resin formerly communicated by him to the Society, concerning which he intimated the difficulty of finding out a menstruum to dissolve it; affirming in the mean time, that what he had sent was purely natural, and had never yet come near the fire, and was made much after the manner, in which indico is made, except that here the plant is bled, or its veins being cut it is dropped into cold water, the sediment of which liquor, he said, was this black resin sent by him, without any further process upon it. He added, that it was a totally inflammable resin; and that it would not be brought to dissolve or give its tincture by any means hitherto used by him, which, he observed, had not been a few.

Mr. OLDENBURG communicated a third letter to himself from Signor CASSINI, dated at Paris 24th October, 1676, acquainting the Society with some of the astronomical observations made in 1672, by Monf. ROCHER at Cayenne in America, whither he had been sent by the Royal Academy of Sciences at Paris, on purpose to make such observations.

November 20. At a meeting of the COUNCIL were present

[h] It is inserted in the Register, vol. v. p. 168.

[i] It is printed in his *Anatomy of Plants*, b. 4. p. 163.

[k] This letter and a former on the same subject, dated 7th April, 1676, are printed in the Philos. Transact. vol. xi. n° 129. p. 724. *& seqq.*

 The

The lord viscount BROUNCKER, president,

Sir PAUL NEILE, Mr. MILLES,
Dr. CROUNE, Mr. HILL,
Dr. GREW, Mr. OLDENBURG.
Mr. COLWALL,

A committee of the council was appointed for auditing the treasurer's accounts, consisting of the president, Dr. CROUNE, Mr. MILLES, Mr. HILL, and Mr. OLDENBURG.

Upon a debate how to proceed with those members of the Society, who had not yet sealed the bond, nor paid their arrears, it was ordered,

That the bond for payment of the weekly contributions to the Society be offered by Mr. WICKS, their clerk, to every member, who had not yet sealed it; and that in case any person should refuse to seal the said bond, his final answer be by the said clerk reported to the council, that so they might know, whether they ought to look upon such person any longer as a member of the said Society, or not.

It was ordered, that Dr. MEIBOMIUS's two books, *de Triremium fabrica*, and *de Proportionibus*, be bought for the library of the Society.

Dr. CROUNE and Mr. HILL brought in their report concerning the *postscript* annexed to the *Lampas*, viz.

"Whereas the publisher of the *Philosophical Transactions* hath made complaint "to the council of the Royal Society of some passages in a late book of Mr. "HOOKE, intituled *Lampas*, and printed by the printer of the said Society, re- "flecting on the integrity and faithfulness of the said publisher in his manage- "ment of the intelligence of the said Society: the council hath thought fit to "declare in behalf of the publisher aforesaid, that they knew nothing of the "publication of the said book: and further, that the said publisher hath carried "himself faithfully and honestly in the management of the intelligence of the "Royal Society, and given no just cause for any such reflections."

This report was approved, and ordered to be printed in the *Philosophical Transactions* [1].

November 23. At a meeting of the COUNCIL were present,

The lord viscount BROUNCKER, president,

Mr. COLWALL, Dr. GREW,
Dr. CROUNE, Mr. OLDENBURG.

[1] It is printed there, nº 129. p. 749.

It

It was ordered, that n° 129 of the *Philosophical Transactions* for the months of October and November, 1676, together with a declaration of this council at their last meeting, ordered to be printed in the next *Transaction*, be printed acordingly.

At a meeting of the SOCIETY on the same day,

Mr. JOHN KING, professor of rhetoric in Gresham-College, was proposed candidate by Mr. HILL.

Mr. OLDENBURG read a relation transmitted from Paris concerning a corrupted kind of rye; growing in some parts of France; as also a narrative of some uncommon effects of tempestuous thunder and lightening near Soissons in France [m].

He read an extract of a letter from Florence concerning a prodigious fire, that appeared there the 31st of March, 1676, sent to the Abbe de la ROQUE at Paris; together with an account sent to Signor CASSINI of the same phænomenon seen at Rome, Genoa, Bologna, Imola, and other places, the same day, and about the same hour, that it appeared at Florence [n].

November 30. Sir RICHARD EDGECOMBE was elected and admitted.

Sir THOMAS CLUTTERBUCK and Mr. KING were elected.

A committee was chosen of the Society for auditing the accounts, which could not be done before, by reason of the president's absence and indisposition, and that no vice-president was present, when this committee should have been chosen. The committee now chosen were Mr. BARRINGTON, Mr. AUBREY, Mr. HAAK, Mr. HOOKE, and Mr. COLLINS.

These went presently apart to examine the said accounts, and both the committee of the council and this committee made their report as follows:

" At a committee of the Royal Society for auditing the treasurer's accounts, November 30, 1676,

" We find the treasurer debtor,

	l.	s.	d.
" To monies he hath received on the several quarterly payments " of the Society, 30th Nov. 1675, to 30th Nov. 1676,	155	1	0
" To money he hath received for admissions - - - - -	9	0	0
" To one year's rent for the fee-farm of the priory of Lewes, due " at Michaelmass, 1675, - - - - - - -	24	0	0
" To the balance of the last account - - - - - -	34	17	5
	£ 222	18	5

[m] This account is printed in the *Journal des Sçavans*, for May, 1674.

[n] These accounts are printed in the same *journal*.

" We

"We find him also creditor,

	l.	s.	d.
"By monies he hath paid for the use of the Society, as appears by "by examination of the vouchers - - - - - -	192	7	8
"By balance resting in cash in his hands, thirty pounds ten shil- "lings and nine pence, - - - - - - -	30	10	9
	£222	18	5

After this Mr. HENSHAW desired, that notice might be taken, that Mr. HOOKE acknowledged to have received the MS. of St. CYPRIAN which Mr. HENSHAW had formerly borrowed out of the Society's library in Arundel-House; and that the engagement, which he had given for it, being in the hands of Mr. OLDENBURG, might be returned to him.

This being done, the Society proceeded to their anniversary election, and continued the following persons in their council for the year ensuing, viz.

The lord viscount BROUNCKER,	Mr. COLWALL,
The earl marshal,	Mr. MILLES,
The lord bishop of Salisbury,	Dr. CROUNE,
Sir JOSEPH WILLIAMSON,	Mr. HILL,
Sir JONAS MOORE,	Mr. OLDENBURG.
Mr. HENSHAW,	

The new members of the council elected were

The lord BERKLEY,	Mr. PEPYS,
Sir JOHN LOWTHER,	Mr. EVELYN,
Mr. AERSKINE,	Dr. WHISTLER,
Sir CHRISTOPHER WREN,	Dr. MAPLETOFT,
Sir JOHN HOSKYNS,	Mr. CREED.

Of this council were elected

The lord viscount BROUNCKER, president,
Mr. COLWALL, treasurer,
Mr. HENSHAW, }
Mr. OLDENBURG, } Secretaries.

Of the new elected members of the council were sworn Sir JOHN LOWTHER, Mr. AERSKINE, Sir CHRISTOPHER WREN, Mr. PEPYS, Mr. EVELYN, Dr. WHISTLER, Dr. MAPLETOFT.

December 7. Mr. HOOKE shewed some magnetical experiments [o].

[o] The particulars were omitted to be entered in the Journal.

 It

It was ordered, that these experiments be prosecuted; and that the committee formerly appointed to take care of the repository be desired to have a good inclinatory needle made, and suspended in the Society's repository, to see what change there would be in it in tract of time; as also to observe, whether this dipping needle answers the latitude from the pole of the world.

Mr. OLDENBURG read a letter from Signor GREGORIO LETI at Genoa to the Society, accompanied with another from him to Mr. OLDENBURG, dated 8th July, 1676, and with four copies of his book, intitled *Italia Regnante*, in four tomes, the fourth of which was dedicated to the Society. One copy of all the four tomes was now presented bound; the other three copies in quires, Mr. OLDENBURG said, should be produced at the next meeting.

It was ordered, that a letter of thanks to Signor LETI should be drawn up by Mr. OLDENBURG.

December 14. At a meeting of the COUNCIL were present,

The lord viscount BROUNCKER, president,

The lord bishop of Salisbury,	Mr. COLWALL,
The lord BERKLEY,	Mr. HILL,
Sir JOHN LOWTHER,	Mr. CREED,
Sir CHRISTOPHER WREN,	Mr. OLDENBURG.
Sir JOHN HOSKYNS,	

Mr. OLDENBURG read a letter to himself, dated at Amsterdam, 1st December, 1676, from a merchant named ELIAS SANDRA, junior, desired to be communicated to the Royal Society, containing an offer made by the said merchant of discovering to the Society such places, where great plenty of ambergrise is to be found; which discovery he would make upon certain conditions and articles accompanying this offer.

The council upon the debate of the whole resolved, that the secretary should return an answer to this offer, viz. that the articles appearing to them to be such, as required personal conferences between the parties contracting for the better understanding of one another's minds, the council would treat with him, if he thought fit to come over: and farther, that they were of opinion, that in case they could agree with him in the rest, they should not differ with him as to his demanded third, nor the import of the first and eighth articles, provided first, that, when he had made the discovery, it should not be found a thing already known; and then that the places of finding the proposed plenty of ambergrise be not subject to some jurisdiction or other of either the English or Dutch East India company, or any other, that might justly oppose or hinder the execution of the design.

Nº 130 of the *Philosophical Transactions* was ordered to be printed by the Society's printer.

At

At a meeting of the SOCIETY on the same day,

Mr. HOOKE, upon account of the presence of Sir JOSEPH WILLIAMSON, one of the principal secretaries of state, repeated his suggestions, made at the last meeting, concerning the dipping needle, viz. that it was very difficult to find what the inclination of the needle should be; and there being no certain way of knowing the needle's inclination, there could be no certainty of knowing the longitude thereby.

He said, that, according as the needles are longer or shorter, they have different inclinations; and that it is not known what distance the dipping needle must have from the magnet for such or such a latitude.

He added, that if we have but the true variations of two places, whose longitudes are exactly known, that will give us the magnetical pole: and then if the variation be true, and the pole given, we need no dipping-needle, because we shall then be able to tell where the needle must dip.

December 21. A motion being made, that the Register and Letter-books of the Society might be reviewed, in order to see what might be fit to be be published; it was ordered, that Dr. WHISTLER, Dr. CROUNE, Mr. HILL, Mr. OLDENBURG, and Mr. HOOKE, or any three of them, be a committee for that purpose; and that they acquaint the president with the particulars, which they shall have thus selected.

Dr. GREW read his lecture concerning the essential and marine salts of vegetables[1], wherein he asserts, that there is no generation of bodies unorganical but what it is in the power of art, by mixing or unmixing, to make or imitate. Several instances whereof were formerly given by him, and the artificial productions in imitation of those of nature viewed and tried before the Society; one of which was a marine or common salt, made out of the lixivial salt of a vegetable; and because this seemed to be doubted of more than the rest by some learned persons then present, he thought it requisite to prosecute the experiment, that, if possible, it might become clear and unquestionable. And because the former method was imperfect, and required a long time (three quarters of a year at least) for the experiment, he said that he had bethought himself of another way, which proved better and much more expeditious, and which withal afforded him not only a true and perfect marine salt out of the salt of a plant, but also a third kind of salt different from both; which may not be improperly called, the essential salt or nitre of plants. The history or manner of the production he gave an account of in his lecture.

167$\frac{6}{7}$, *January* 4. Mr. OLDENBURG produced a present, sent by a gentleman of Germany, named CHRISTIANUS ADOLPHUS BALDUINUS, to the king, as founder of

[1] It is inserted in the Register, vol. v. p. 178. and printed in his Anatomy of Plants, lecture 4. p. 261.

the Royal Society, and to the Society jointly, viz. a ſtony ſubſtance or paſte, which being expoſed a little while to the day-light, or flame of a candle, will ſo imbibe the light, as to ſhine in the dark like a glowing coal.

There being a letter ſent with it, dated 1ſt September, 1676, it was read and ordered to be regiſtered [m], and the preſenter to be ſolemnly thanked by a letter to be drawn up by Mr. OLDENBURG, who propoſed him candidate for election into the Society.

The experiment with this ſhining ſtone was tried, and ſucceeded pretty well, but not ſo well as was expected, it being almoſt night, and very dark weather.

January 11. The ſtone ſhining in the dark was tried again, and fully anſwered the import of the letter of the preſenter.

It gave occaſion of diſcourſe to the Society, whether this ſubſtance gained the light by imbibition; or whether the light was cauſed by a communication of the motion of the ſun's or candle's light, &c.

Dr. CROUNE mentioned, that Mr. BOYLE having publiſhed many experiments, ſhewing, that divers ſubſtances being expoſed to the fire increaſed in weight thereby, it ſeemed worth while to obſerve, whether ſome of thoſe bodies would not ſo receive light, as to render it in the dark.

There was read part of a letter of Dr. BEAL, dated at Yeovil, 27th December, 1676, giving an account of his thermometrical and baroſcopical obſervations in the laſt ſharp froſt; the ſum whereof was, that he never ſaw the liquor in the ſcaled thermometer deſcend near ſo low as it was from December 15 to December 20; and that the barometer ſtood at a more than ordinary hight in the extreme froſt; but deſcended a quarter of an inch a-day before the alteration appeared, and was on the 27th of December at the higheſt again.

January 18. Dr. Grew entertained the Society with a lecture concerning experiments in conſort upon the diſſolution of ſalts in water [n].

In this diſcourſe he examined and ſhewed before the Society, that water having been fully impregnated with one kind of ſalt, ſo as to bear no more of that kind, it will yet bear or diſſolve ſome portion of another, and ſo of a third: the doing of which having brought into his mind divers other experiments relating thereto, he delivered them likewiſe in this diſcourſe: as

1. With what difference this ſuper-impregnation may be made upon the ſolution of different ſalts.

[m] It is printed in the Philoſoph. Tranſact. vol. xi. n° 131. p. 788.

[n] It is inſerted in the Regiſter, vol. v. p. 188. and printed in his *Anatomy of Plants*, lecture 7. p. 296.

2. Whether the solution of a smaller quantity of several salts is not consistent with the non increase of the bulk of the water.

3. What quantity of the several kinds of salt may be dissolved severally in the same quantity of water.

4. Whether by dissolving a salt in water, there be any space gained or not; that is, whether the bulk of the water be greater before the salt lying in it be fully dissolved, than afterwards.

5. Whether the space be equally gained by an equal increase of the same salt.

6. Whether upon dissolution of the several kinds of salts be gained so many several quantities of spaces.

7. What that just space may be, which any salt gains with respect to itself or its own bulk.

8. What that just space may be, which any salt gains with respect to the bulk of the water.

The experiments of all which he explained in the discourse itself.

It was ordered, that the experiment of dissolving several salts, one after another, in water, as common salt, nitre, alums, sal armoniac, should be tried before the Society at their next meeting.

Mr. Henshaw presented from Sir John Clayton a piece of the Bononian stone.

Mr. Oldenburg read a letter from Dr. Muraltus, a physician of Zurich, dated 20th December, 1676, concerning the generation of crystal.

January 25. At a meeting of the Council were present

The lord viscount Brouncker, president:

Mr. Aerskine,	Mr. Milles,
Sir John Lowther,	Mr. Hill,
Mr. Henshaw,	Mr. Creed,
Mr. Colwall,	Mr. Oldenburg.

Mr. Henshaw was sworn vice-president of the Royal Society.

Mr. Oldenburg acquainted the council from the earl marshal, that his lordship was desirous, that the library at Arundel House given by him to the Royal Society might be better looked after: as also, that he should be glad to have those books of that library delivered to him, which he had reserved out of it to himself at the time of the donation thereof, viz. books of heraldry and genealogy.

It

It was ordered hereupon, that Sir JOHN HOSKYNS, Mr. EVELYN, Mr. HILL, and Mr. OLDENBURG, or any two or more of them, ſhould be a committee to attend the earl marſhal, to deliver to his lordſhip ſuch books as he had reſerved to himſelf out of the Arundelian library; as alſo to ſecure that library from damage.

It was ordered likewiſe, that the apothecary's bill for the laſt ſickneſs of the late Mr. SHORTGRAVE [o], amounting to about five pounds, be paid by the treaſurer, Mr. SHORTGRAVE's widow having firſt delivered up to Mr. HUNT all the inſtruments, utenſils, &c. belonging to the Society, ſo that ſatisfaction be given in this matter to the committee appointed for taking care of the repoſitory.

N° 131 of the *Philoſophical Tranſactions* for January, 1676/7, was licenſed.

Mr. HUNT was ordered to take a copy of the picture of the late Dr. WILKINS, lord biſhop of Cheſter.

It was ordered, that the aſtronomical inſtruments belonging to the Society, and being in their repoſitory at Greſham College, be lent to the obſervatory at Greenwich, for making aſtronomical obſervations; and that Mr. HOOKE's new quadrant be forthwith finiſhed at the charges of the Society.

Mr. OLDENBURG read a letter from Mr. ELIAS SANDRA, junior, merchant at Amſterdam, dated 22d January, 1676/7, being a return to the anſwer ſent to him from the council upon his firſt letter, concerning the propoſition of diſcovering a great plenty of ambergriſe: the ſubſtance of which letter being, that he deſired to know the thoughts of the council with regard to the reſt of the articles formerly propoſed by him, the council cauſed thoſe articles to be read; and ordered thereupon, that as to the articles for ſecrecy, they could not be kept ſecret from thoſe, whom the council ſhould make uſe of in this matter. As to the fifth article, it would be the concern and intereſt of the council to oblige thoſe, who ſhould go out upon the deſign, to follow Mr. SANDRA's directions relating to the place, where the ſaid plenty of ambergriſe is to be found. As to the ſixth article, the diſcoverer's third part ſhould be brought free and without any expence to him into England. As to the eighth article, the council would not be tied to ſecrecy of a general but a particular diſcovery.

At a meeting of the SOCIETY on the ſame day,

Mr. OLDENBURG read a letter of Mr. HEVELIUS, dated at Dantzick, 2d January, 1676/7, N. S. [p] concerning his late obſervations of the new ſtars *in collo ceti & pectore cygni*; together with ephemerides of the ſeveral phænomena of theſe ſtars from the very firſt time of their appearance.

It was ordered, that Mr. HEVELIUS be deſired, in the name of the Society,

[o] The Society's operator.

[p] Supplement to the Letter-book, vol. iv. p. 176. It is printed in the Philoſoph. Tranſact. vol. xii. n° 134. p. 853. for April, 1677.

to finish his catalogue of the fixed stars, and that an intimation be given to him of the agreement of Mr. FLAMSTEAD's observations concerning the distances of many of those stars with his observations, of which he would, before it was long, see something in print: and farther, that what Mr. HOOKE had published against him, was done without any approbation or countenance from the Society.

It was moved, that the making of the inclinatory needle formerly spoken of[q], should be hastened by Mr. HOOKE, in the exactest manner, that could be.

Dr. GREW began to make the experiment, appointed at the last meeting, of impregnating water fully with one kind of salt, so as that it would bear no more of that kind; and then to dissolve some portion of another, and so of a third.

The president suggested, that one sort of salt being mixed with water, in such a quantity, as that no more of it would be dissolved thereby, the glass should be sealed up, and so set by till the next meeting; and then the same water to be impregnated with another kind of salt, and suffered to stand still again another week, and so on.

Mr. OLDENBURG read two letters written by Mr. CHOLMONDELEY, put into his hands by Sir JOHN WERDEN, concerning little crustaceous live animals, found by the said Mr. CHOLMONDELEY himself, both floating upon mercury in a barometer, and at the bottom of the same.

This being looked upon as extraordinary, that such creatures should be bred in mercury, it being supposed, that they were rather bred from the wooden box, wherein the stagnant quicksilver was; it was ordered, that the observer should be desired to try with the same quicksilver in a glass-cane turned up, and to see, whether he could then find any such animal in it.

February 1. There was read part of a very long letter of Mr. LEEWENHOECK to Mr. OLDENBURG, dated at Delft, 9th October, 1676, which had not been produced before, because it could not be sooner translated into English out of the Low Dutch language, in which it was written. The contents thereof were a great number of observations made by Mr. LEEWENHOECK with his microscope, concerning certain little animals found by him in vast quantities in common water, snow-water, well-water, and such water, wherein several sorts of spices had stood infused, both whole and pounded[r].

It was ordered, that the sequel of these observations should be read at the next meeting; and that the author be desired to communicate his method of observing.

There was also read part of a printed paper, intitled, *Noctiluca volans & per vices fulgurans*, composed by Dr. KIRCHMAYERUS, professor at Wittemberg in

[q] December 7 and 14, 1676.

[r] These observations are printed in the Philos. Transact. vol. xii. n° 133. p. 821. for March, 1677.

Germany;

Germany; and containing a relation of the author of this fubftance, and of its performances.

It was ordered, that the author of this book fhould be defired to fend a fpecimen of this fubftance, for a trial, as Dr. BALDUINUS had done of his fhining ftone.

February 8. Sir GEORGE CROOKE was elected and admitted.

Dr. BALDUINUS, who had prefented the king and Society with the ftone fhining in the dark, was elected.

Mr. JOHN FLAMSTEAD was elected, Sir JONAS MOORE and Mr. DANIEL COLWALL affirming, that he had been formerly propofed, though it appeared not upon the Journal, that he had been fo.

Dr. GREW read a lecture, beginning the comparative anatomy of animals, of which he had opened eight of the fmaller kind, viz. a weafel, a polecat, an urchin, a fquirrel, a fpaniel-bitch, a rabbet, a fox, and a fheep: of all which he difcourfed [t], and fhewed their entrails.

The Society being very well pleafed with this defign, and this beginning of the execution thereof, exhorted Dr. GREW to perfue this argument with all poffible care and expedition and to leave in the repofitory thofe parts, which he fhould from time to time produce upon occafion of his lectures.

Mr. HENSHAW prefented to the Society from Sir JOHN CLAYTON a piece of the Bononian ftone, which fhines, when duly prepared, in the dark; together with Dr. MENTZELIUS's book concerning the method of preparing it.

It was ordered, that Dr. MAPLETOFT and Dr. CROUNE take care of the preparation of this ftone, in order to make it fhine in the dark.

February 15. The glafs of water impregnated with common falt a fortnight before was produced; and the water having left undiffolved a confiderable quantity of the faid falt, it was by order of the Society poured off, and five drachms of nitre put in the fame, and fo fealed up.

Mr. OLDENBURG produced the fequel of Mr. LEEWENHOECK's letter concerning the great plenty of very little animals obferved in rain, well, fea, and fnow-water; as alfo in water, in which pepper had lain infufed.

The remainder of this paper was referred to another meeting; and the fecretary was again defired to procure from Mr. LEEWENHOECK his method of obferving, that

[t] His difcourfe is entered in the Regifter, vol. v. p. 195. The fubftance of it is publifhed in his *Comparative Anatomy of Stomachs and guts begun*; fubjoined to his *Mufæum Regalis Societatis*, printed at London, 1681, in folio.

by

by making use of the same, the Society might be enabled to confirm his observations.

One Mr. Wynne produced an inclinatory needle, which being tried and found imperfect, the artist was solicited to endeavour to make an exact one; which he promised to do.

An extract of a letter of Dr. Wallis, dated at Oxford 30th January, 167$\frac{6}{7}$, was read, concerning the meteor seen 20th September, 1676, in and near Oxford, and in many other parts of England [u].

February 22. Sir John Lowther produced the figure of a goose-egg, with another within it, which had been both of them hard, and were laid at Brougham in March 167$\frac{5}{6}$. They were said to have been, in every respect, like other eggs, except the size of the outermost, which had been ten inches about breadthwise, and fourteen inches length-way; and after the yolk and white of the outer egg was poured out at a little hole, the inner egg moved up and down within it.

The third part of Mr. Leewenhoeck's observations concerning living creatures in water, in which pepper had been infused, was read.

The glass, wherein at the last meeting was put some nitre, being produced, and the nitre found to be all dissolved, more of the same nitre was put in, to see, whether it would dissolve this likewise.

March 1. Another inclinatory needle was tried, and proved to be better than the former. However, the artist was still pressed to try to make another yet more exact.

Mr. Henshaw shewed the Society a magnetical experiment, of taking a bar of iron, and holding it perpendicularly to the horizon, and upon applying to the lower end of the iron a needle touched with a loadstone, the south pole of the needle turned to the lower end of the iron; but upon applying the needle to the upper end of the iron, the north pole of the needle turned to that end of the iron, which was uppermost. Again, upon applying the needle suddenly to the middle of the iron so erected, neither pole of the needle would turn to the iron, but the needle turned its side only, and stood due north and south. So likewise, if he held the iron parallel to the horizon, and applied the east or west side of the dial to the iron, neither pole of the needle would regard the iron, but the needle stood due north and south. But that, which was most strange, was, that to either end of the iron (if it had not been touched with a loadstone) turn it downward or upward as nimbly as you can, the needle will as nimbly turn its north pole, when it is erected, and its south pole, when it is depressed; and either end of the same iron produces the like effect.

[u] This letter of Dr. Wallis, and one of the 20th of January, 167$\frac{6}{7}$, and another of 8th May, 1677, are printed in the Philosoph. Transact. vol. xii. n° 135. p. 863. & seqq.

This

This experiment was ordered to be regiſtered, when Mr. HENSHAW ſhould have fully delivered it in writing, which he was deſired to do.

March 8. The African company ſent by Mr. CRISPE to the Society for a preſent an uncommon horn, thought to be an elephant's tooth, which was wreathed in an extraordinary manner, affirmed to have been brought by a captain of a ſhip from the river Gambia.

Dr. GREW read a lecture concerning the proportion of the fixed ſalts of one plant, or part of a plant, to the fixed ſalt of another, and to all the other principles in any one plant [x], as

1. What proportion the fixed ſalt of the pith, or pithy part of a plant bears to that either of the fibrous or woody part; or whether there be a fixed ſalt always found in either of them?

2. Whether the bark or the wood of the ſame tree yields the greateſt quantity of fixed ſalt?

3. Whether the bark of the body or the bark of the root; and ſo whether the wood of the body, or the wood of the root of the ſame tree, yields moſt fixed ſalt?

4. Whether trees, herbs, and buſhes, quantity for quantity, *& cæteris paribus*, yield the moſt fixed ſalts?

5. Whether of two plants of the ſame kindred, one growing in the field, the other on the ſea-coaſt, that near the ſea doth not yield a greater quantity of fixed ſalt?

6. Whether a plant yields more ſalt, being only dried and then calcined, or being firſt diſtilled, and then calcined?

7. What different quantities of ſalt the tartars of ſeveral ſorts of wine do yield; as of whites, claret, Rheniſh, &c? whence partly the ſtrength and nature of wines may be judged.

8. How far the proportion of ſalt is different, according to the different taſtes of plants? inſtanced in ſeven ſeveral taſtes.

9. How far the proportions of the fixed ſalts of plants vary according to their faculties; and firſt, thoſe, that are only alterative and opening; next thoſe, that are thoracics, antiſcorbutics, antihyſterics, ſtomachics, cephalics, diuretics?

[x] It is inſerted in the Regiſter, vol. v. p. 206. and printed in his *Anatomy of Plants*, lecture 3. p. 255.

10. How far the proportions of the salts of plants do vary according to their cathartic faculties?

11. How far gums and resins obtain a different proportion of salt, according to their different virtues? as of resin, mastic, olibanum, asa fœtida, gum Arabic, euphorbium, myrrh, opium, aloe, gum guaiacum, scammony, and gutta Gamba.

From which he collected, that there is no purging gum without some portion, more or less, of a fixed alcali: so that it seems, that the fixed alcali, as it is combined with the other principles, some way or other, has some interest in the business of purgation. 2. That considering the dose of any purging gum, the quantity of the fixed alcali must needs be extremely small in comparison with the volatile parts of the gum, wherein therefore its purgative power principally consists. 3. That of these volatile parts the purgative force lies neither in the sulphur, nor in the salt alone, but in both, as intimately united one to another, and to their alkali into one body, as appears from the calcination.

March 15. Mr. WYNNE produced two other inclinatory needles, both which stood true, before they were touched, at any degrees, where they were put. And one of them being touched on both ends stood at seventy-three degrees one way and seventy-four and an half the other way, tried several times. The other being touched first at one end only, stood at seventy-two degrees and one fourth one way and seventy-three degrees the other way; but when afterwards it was touched at both ends, it stood at seventy-three degrees and three fourths one way, and seventy-three degrees and one fourth the other way.

Mr. OLDENBURG produced a letter sent to him by an anonymous member of the Society, concerning Mr. HENRY BOND's book, intitled, *Longitude found* [y]; which being read, it was ordered, that Mr. COLWALL should be desired to ask Mr. BOND, how he came to know the difference of longitude between London and Waygatz to be fifty-eight degrees.

Sir ROBERT SOUTHWELL sent for the repository an odd leg of an human body, which he had brought with him out of Ireland; in which leg there seemed to have been an extraordinary ulcer, which had swelled the ancle-bones.

Mr. HILL gave for the repository a cone, said to be the dried fruit of a cedar-tree of Lebanon.

March 22. There was read an account communicated by the earl marshal, of the diamond-mines in the East-Indies, their number, variety, manner of working them, together with the several sizes and prices of diamonds: which account was ordered to be printed in the *Philosophical Transactions* [z], if leave should be given by his lordship.

[y] Printed at London, 1676, in 4to. See Philosoph. Transact. vol. xi. n° 130. p. 774.

[z] It is printed there, vol. xii. n° 136. p. 907. for June, 1677.

Mr.

Mr. OLDENBURG read a letter to himself from Dr. WALLIS, dated at Oxford, 14th March, 167$\frac{6}{7}$ [a], concerning a new musical observation, viz. that whereas it hath long since been observed, that if a viol or lute-string be touched, another string on the same or another instrument not far from it, if an unison to it, or an octave, will at the same time tremble of its own accord; it hath been farther noted, that not the whole of that other string doth thus tremble, but the several parts severally, according as they are unisons to the whole or to the parts of that string: and besides, that the same string being struck in the midst, each part being unison to the other will give no clear sound at all, but very confused, &c.

This experiment was in part tried, and found to answer the import of the letter.

1677. *March* 29. Mr. POVEY produced a model of the sepulchre of our Saviour at Jerusalem, said to have been made upon the place by the Maronites.

It was ordered, that Mr. HENSHAW's account of the magnetical experiment, made before the Society on the 1st of that month of March, be entered into the Register [b].

Mr. OLDENBURG read a letter writen to himself from Mr. GEORGE GARDEN, dated at Aberdeen, 17th February, 167$\frac{6}{7}$ [c], concerning a man in those parts of a dottrel quality, naturally imitating whatever he saw others do, and not being able to forbear such imitation: as also concerning a woman, who had voided a stone of more than five inches about one way, and four inches the other way; together with an offer of sending the stone to the Society: which offer was accepted.

April 5. Mr. OLDENBURG produced a piece of a pig's gut, in which an incision had been made, whilst the pig was alive, by opening its belly, and pulling out the guts, and giving it a cut lengthwise, and then applying Monf. REBEL's vulnerary water, and so putting it in again. Whereupon the pig growing well again, and being fattened for brawn, it was at length killed for that purpose; and this gut being looked after, was found perfectly and strongly healed up again. This gut being sent by his highness prince RUPERT, who had himself caused the said incision to be made, it was ordered, that the humble thanks of the Society should be returned to him, and that it be intimated, that it would be worth while to try, whether such an incision would not heal of itself without the application of any thing.

Mr. BOYLE sent in by Mr. OLDENBURG the proposal of a magnetical experiment, to observe, whether the virtue of a loadstone would be diminished or increased by several accidents.

[a] It is printed in the Philosoph. Transact. vol. xii. n° 134. p. 839. for April, 1677.

[b] It does not appear there.

[c] It is printed in the Philosoph. Transact. n° 134. p. 842.

It was ordered, that the apparatus ſhould be made ready for trying the propoſed experiment; which apparatus was recommended by Mr. BOYLE himſelf after this manner:

Apply to the caps of a loadſtone a thin ſmooth plate of ſteel of ſmall breadth and convenient length; from the midſt of which plate ſhould reach downward a little moveable hook, at which a light ſcale might be ſo hung, that when it is laden, the centre of gravity of the weight or weights, together with the plate, may hang moſt conveniently for the ſuſtentation of the whole by the loadſtone. Into this ſcale, by little and little, ſmall weights are to be put in, till the addition of a very little more, as of a grain or two, or leſs, is able to draw down the plate. Then this plate and the annexed ſcale being again applied in the convenienteſt manner to the caps of the loadſtone, the whole is to be kept ſuſpended in a very quiet place, to obſerve, whether the changes of the moon (diurnal or menſtrual) the tides, the ſeaſons of the year, the apogeum or perigeum of the ſun, the generation of the ſolar ſpots, boiſterous and laſting winds, great variations of the atmoſphere's weight, conflagration of buildings, &c. will ſeparate the plate from the loadſtone, or enable it to ſuſtain a greater weight. The like trials may be made of the diſpoſitive or attractive power of the loadſtone, by a needle placed juſt at ſuch a diſtance, as may be looked upon to be the utmoſt in the ſphere of the activity of the magnet.

It was mentioned, that Mr. GREATERIX had affirmed of the great loadſtone of the lord viſcount BALTIMORE, that it would take up leſs in froſt than in warm weather.

It was alſo remarked, that it would be worth trying, whether a needle being well touched at a loadſtone, the ſtone would thereby loſe any thing of its weight.

A letter of Mr. LEEWENHOECK to Mr. OLDENBURG, dated at Delft, 23d March $167\frac{6}{7}$, was read, giving ſome account of his obſerving live animals in water [d].

It was ordered, that Dr. GREW ſhould be deſired to try what he could obſerve in the like waters; and that for this purpoſe an extract ſhould be given him by Mr. OLDENBURG of Mr. LEEWENHOECK's obſervations formerly read to the Society.

April 12, 19, 26, the SOCIETY did not meet.

May 3. Dr. GREW read a diſcourſe concerning his obſervations and experiments on the colour of plants: which diſcourſe had three general heads:

1. Of the ſeveral colours, as they appear in the plants themſelves.

[d] It is printed in the Philoſoph. Tranſact. vol. xii. n° 134. p. 844.

2. Of

2. Of these colours, as they appear upon infusion into several sorts of liquors.

3. Of the colours, as they appear upon the mixture of those infusions, or any of them, with some other liquors, and particularly with oil, spirit of wine, and water.

The sum of what he discoursed of the causes of vegetable colours, was, that when the sulphureous and saline principles, though swimming together, yet are not yet united into one precipitate, no colour results from them, but the liquors are white or limpid, as usually in the root, and many other parenchemous parts.

When they are mixed, and the alkali is predominant, they produce a green: when the sulphur and the alkali are more equal, they produce a tawny: when the sulphur, acid, and alkali are more equal, then yellow: when the sulphur is predominant, and the acid and alkali equal, then a purple: when the sulphur is predominant to the alkali, and the acid to them both, then a scarlet: when the acid is predominant to the alkali, and the sulphur to them both, then they yield a blood red, which is the highest and most sulphureous colour in nature.

This discourse was ordered to be entered into the Register-book [e].

May 10. There was read a relation sent by RALPH BATHURST, M. D. dean of Wells, concerning very unusual damps, and their odd effects in a coal-mine in Flintshire [f], communicated by ROGER MOSTYN, Esq; of the Inner-Temple, who, at Dr. BATHURST's request, had obtained it from his father's steward and overseer of his coal-works, who was upon the place, when the thing happened; Mr. MOSTYN being also assured of it from his father Sir ROGER MOSTYN, lord of the manor, and from several others, who were eye-witnesses.

May 17. There were read three letters sent to Mr OLDENBURG from foreign parts, concerning the late comet, one from Mr. HEVELIUS, dated 1st May, 1677, N. S. [g]: the second from Signor CASSINI, dated at Paris, 9th May, 1677. N. S. [h]; and the third from Dr. ERICUS MAURICIUS, dated at Spire, 26th April, 1677.

Mr. FLAMSTEAD's letter to Mr. OLDENBURG, dated at Greenwich, 18th May, 1677, containing his observations on that comet [i], was likewise read.

Mr. OLDENBURG produced a letter to himself from Mr. LEEWENHOECK, dated at Delft, 14th May, 1677, concerning the observations made by him of the carneous fibres of a muscle, and the cortic and medullary part of the brain; as also of *moxa* and cotton [k].

[e] It does not appear there: but it is printed in his *Anatomy of Plants*, lecture 5. p. 269.
[f] It is printed in the Philosoph. Transact. vol. xii. n° 136. p. 895. for June. 1677.
[g] It is printed in the Philosoph. Transact. vol. xii. n° 135. p. 869.
[h] Ibid. p. 868.
[i] Ibid. p. 873.
[k] Ibid. n° 136. p 889.

Part of this letter was read, and the reſt ordered to be read, as ſoon as it could be tranſlated into Engliſh from the Low Dutch.

Mr. OLDENBURG read a letter to himſelf from Monſ. LEIBNITZ, dated at Hanover, *May* $\frac{3}{13}$, 1677, giving an account of a ſubſtance, which carried its light perpetually within itſelf, and needed not to be expoſed to imbibe light.

There was likewiſe read a letter of Dr. WALLIS's to Mr. OLDENBURG, dated at Oxford, 8th May, 1677 [l], giving a fuller account than his two former letters of 20th and 30th January, of an unuſual appearance, September 20, 1676, at Oxford, and in many other parts of England; which the Dr. was inclined to think to be rather a comet, than a meteor, for the reaſon delivered in this letter.

May 24. There was produced a printed book in French, intitled, *La Duplication du Cube, la Triſection de l'Angle, & l'Inſcription reguliere d'un Heptagon dans un cercle: par Monſ.* COMIERS.

Mr. OLDENBURG mentioned, that he had ſhewn this book to the preſident, who having examined it, affirmed, that the author had performed what he had undertaken. Dr. WALLIS being preſent, was deſired to conſider it likewiſe, and to report his ſenſe of it to the Society.

A ſecond letter of Mr. HEVELIUS to Mr. OLDENBURG concerning the late comet, dated at Dantzick, 13th May, 1677, N. S. [m], was read.

Mr. OLDENBURG produced Signor CASSINI's printed diſcourſe concerning a new theory of the moon invented by him: which being read, Mr. FLAMSTEAD was deſired to take it with him, and to conſider it.

Mr. OLDENBURG ſhewed the Society the ſcheme of an engine called *machina metereo-poetica*, together with an explication of it; which was read, but not thought ſatisfactory.

May 31. [n] Read Monſ. LEEWENHOECK and Dr. WALLIS's account of the duplication of cubes, and of the inſtant motion of light.

Captain FISSENDEN preſented two rarities, a ſea fungus coralloides, and the ſhell of an echinus, matrix of helmet-ſtones.

June 7. Of a ſalt of Centaurium minus, which being kindled maketh as great noiſe as gun-powder.

[l] It is printed in the Philoſoph. Tranſact. n° 135. p. 864.

[m] Ibid. p. 871.

[n] The minutes of this and the two following meetings are from the ſhort ones of Mr. OLDENBURG, taken at thoſe meetings, which notes he did not draw out to their due length; for which reaſon they were not tranſcribed into the Journal-books of the Society, vol. v.

The

The ſame ſpake of another ſalt made of a vegetable, which he names not, which is alſo a gun-powder, and ſhoots a bullet with almoſt the ſame ſtrength that gun-powder does, and with the ſame noiſe.

Of a white loadſtone found in a cabinet of a curious perſon, which hath the ſame power with the beſt magnet of the ordinary colour.

Anatomical obſervation, that the cuticula in ſome animals hath no pores: that RIOLAN and ſome others affirm, women have none; but they ſweat as well as men: but that it is true in dogs and cats, who never ſweat, what labour ſoever they be put to.

Blue bottle beaten with its involucrum, and infuſed twenty-four hours in ſnow-water, communicates ſo great a virtue to this water, that, when diſtilled with a moderate heat of ſand, it not only removes all the inflammations of eyes, but alſo clears and fortifies and preſerves the ſight, eſpecially of aged perſons: whence the French call it *caſſe-lunette:* put only ſome drops of it in the eye.

Abroad, ſtudying to recover the way of making that ſort of fire, which they called Greek-fire, which increaſed its force in the water; ſo called, becauſe the Greeks made uſe of it, which was about the end of the ſeventh age. Of which they find it recorded in hiſtory, which is newly inſerted in the *Hiſtory of the Cruſades*, written by the jeſuit MAIMBOURG [o], that it was invented by an engineer of Heliopolis in Syria, called CALLINICUS, who made ſo good uſe of it in the battle, which the naval army of the emperor CONSTANTINE POGONATUS delivered to the Saracens near Cyzicum in the Helleſpont, that the Chriſtians burned their whole fleet conſiſting of thirty thouſand men, which were all conſumed in the midſt of the water, together with their ſhips. This fire was compoſed of brimſtone, naphtha, pitch, and ſome gum drawn out of certain trees, and of a bitumen infuſed in a fountain-water of a peculiar make, and of ſome other ingredients capable to produce that effect. And this fire had this particular quality, that it faſtened ſo cloſe to people, and to things, that were to be burnt, that it could not be removed but with vinegar mingled with wine and ſand; and, which is much ſtranger, oil itſelf, which ſerves for food to other fires, and makes them more vigorous, ſerved to extinguiſh that fire.

To make experiments, whether ſeveral needles will mark the ſame magnetical meridian.

Four needles of ſeveral lengths would not vary in ſhewing the true magnetical meridian. Of 2, 4, 6, 8 inches, two of the ſame length will mark alike.

The needles with two different loadſtones ſhew different meridians. Needles not touched.

[o] Printed at Paris, 1676, in 4to.

June

June 21. [p] Horfes gut thirty-feven yards long.

Ufes: gullet and its parts, dog more mufcular, bones.

Ventricle: all quadrupeds carnivorous fmall ftomach.

Sheep and oxen very large ftomach.

Horfe and hare no great ftomach, becaufe they much labour and run.

The ftomach of carnivorous animals of . . . fingle.

Granivorous animals have double ftomachs.

Method of rumination very fine: the nervous papillæ have a tafte and difcern.

To difcontinue the meeting till a new fummons.

September 13. At a meeting of the COUNCIL were prefent

Mr. HENSHAW, vice-prefident, in the chair,
Sir JOHN HOSKYNS, Mr. COLWALL,
Sir CHRISTOPHER WREN, Mr. HILL.
Sir JOHN LOWTHER,

It was refolved, that at the next meeting of the council, the ftatute now propofed for taking notes by a balloting-box be read, viz.

"For the more free and private giving of notes at the council of the Royal "Society, be it ordered, and it is ordered, that henceforth all votes in paffing "queftions at meetings of the council fhall be taken by a balloting box."

It was ordered, that Mr. BERNARD have two Arabic Pfalters out of the Arundel library, giving fecurity, fuch as Mr. HOOKE fhall approve, for returning them within fix months, provide the earl marfhal confent:

That Mr. BOYLE, Sir JOHN HOSKYNS, and Mr. HILL, or any two of them, do at ten of the clock the next morning go to the widow of Mr. OLDENBURG, Efq; late fecretary of the Society, and demand, receive, or take order for fecuring, for the ufe of the Society, all fuch goods, books, and writings belonging to the Society, as were or had been in the poffeffion of her, or of her late hufband: and

That Mr. HOOKE agree with Mr. FORSTER for making the catalogue of the Arundel library: and that what he fhall agree for, be paid by the treafurer.

September 24. At a meeting of the COUNCIL were prefent

[p] The minutes of this day are the heads of Dr. GREW's lecture publifhed in his *Comparative Anatomy of Stomachs and Guts*, p. 12—27.

Mr. HENSHAW, vice-president, in the chair,

Sir JOHN HOSKYNS,	Mr. COLWALL,
Mr. AERSKIN,	Mr. HILL,
Sir JONAS MOORE,	Dr. CROUNE.

This council met by order of Mr. HENSHAW, who on the 21st instant, in the absence of the president, ordered Mr HUNT to summon a meeting of the council on this day.

Upon reading the case of Mr. OLDENBURG's children and Sir RICHARD LLOYD's opinion thereupon, it was ordered, that MICHAEL WICKS [q], and HENRY HUNT [r], be named commissioners on behalf of the Society: and that Mr. HUNT give notice hereof to Mr. BOYLE; and that the persons in possession of the house [s] be desired to keep possession, unless demanded with Mr. BOYLE's consent.

It was ordered, that when any letters concerning the Society be directed to the secretary, what concerns the Society shall be read at the meeting of the Society next after the receit of such letters:

That all papers and books concerning the Society be kept in the repository or library of the said Society: and that if any thing be to be transcribed, it be done there:

That the officiating secretary taking short notes of all that passes at the Society or Council, before the rising thereof, read the said notes, in order to see, that they be rightly taken: And,

That the notes so taken be fairly entered by the next meeting-day respectively.

The statute for taking votes at the council by ballot propounded at the last meeting was passed as a statute.

The council adjourned till the Thursday following September 27, at three in the afternoon.

September 27. At a meeting of the COUNCIL were present

Mr HENSHAW, vice-president, in the chair,

Sir CHRISTOPHER WREN,	Mr. HILL,
Sir JOHN HOSKYNS,	Dr. WHISTLER,
Mr. COLWALL,	

It was ordered, that Mr. HILL desire Dr. POPE not to dispose of his lodgings till the council have notice.

Adjourned till that day fortnight, October 11:

[q] The clerk. [r] The operator. [s] Inhabited by the late Mr. OLDENBURG.

October

October 15, 1677. The Society met again at their usual place in Gresham-College upon summons sent for that purpose by the president.

The president not coming, the vice-precident Mr. HENSHAW and the rest of the Society desired, that an experiment might be shewn; which was accordingly done by Mr. HOOKE; the effect of which was to shew a very easy but exceedingly curious way to examine the comparative weight of liquors, and that to so great a niceness, as very sensibly and manifestly to exhibit such weight of two liquors, though they differed from one another but a thousandth part of their weight. This was performed by the help of a large glass of a pear-like form, equalling in bulk about three pounds of water, which by that included in it was made almost equiponderant to the water, but yet somewhat heavier, that it might sink to the bottom; but by the finest hair tyed to the stalk could be suspended in the water. This hair was tyed to the scale of a beam, and this poise by a counterpoise in the other scale was made to swim in the water so, as neither to touch the bottom nor the top; and when so poised, it was found, that a fifth part of a grain added to or taken from the scale would make the glass-pear rise to the top or sink to the bottom. Whence it was evident, that the whole glass weighing about four pounds, which amounts to 22040 grains, or 220400 tenth parts of a grain, one single tenth part of a grain would turn it. And the glass, when suspended, being always equal to equal bulk of water, if that might be altered, the poise must be altered; and consequently by help of the scales be made sensible. This experiment and the nicety thereof being understood by the members present, it was desired, that trials might be made at the next meeting upon several sorts of water, as pump water, New River water, Thames water, and rain water, that so they might be experimentally satisfied of the exactness of this new instrument; which was new upon this account, that it had not been taken notice of by any of those, who had written of this subject, such as, GHETALDUS, SEVINUS, PASCAL, &c. they having only taken the comparative weight of some small counterpoise within and out of the same liquor, which they had always performed with the same scales; which are no ways fit for exhibiting the niceness and curiosity of this experiment. Several objections were made and answered, and Dr. WHISTLER explained some things in it, which seemed a little difficult[t].

This debate being over, it having been concluded in some foregoing * * the vice-president Mr. HENSHAW with the rest of the members desired Mr. HOOKE, Mr. OLDENBURG having died since the last recess, to take his place at the table, and to take an account of such considerable matters, as should be shewn or discoursed of at the meetings of the Society; which he accordingly did.

Sir JOHN HOSKYNS, Mr. HENSHAW not being then present, proposed Mr. THOMAS SMITH, chaplain to Sir JOSEPH WILLIAMSON, one of the principal secretaries of state, as a candidate for election into the Society, being seconded by Dr. HOLDER, and others.

[t] The description of this water-poise is published in the Philosoph. Transact. n° 197. p. 639.

Mr. HOOKE acquainted the Society with a new ſort of leather found out at Paris, and made impervious to air and water; ſo that therewith had been made all ſorts of riding and wearing apparel to keep out wet, cups and borachio's to hold or carry liquors, beds to lie on, and floats to ſwim with, which hold air like a bladder, covers of tents, coaches, ſedans, mails, &c. floors to tread on dry in marſhy places, boots to wade in, &c. And he preſented from Mr. BOYLE a cup made of the ſame leather, which, he affirmed, held water ſix days without ſoaking through the leather, though as thin as a Corduban glove; and alſo ſupple.

Mr. PACKER remarked, that it was fit for hat-caſes, ſtockings, &c.

Mr. HOOKE mentioned, that he conceived it to be done only by ſoaking the leather in a mixture made with ſalad oil, and well boiled together. He was deſired to make trial of this way againſt the next meeting.

Mr. HOOKE ſhewed a ſort of Portugal onion, which he had received from Dr. WHISTLER, who called it viviparous; the ſaid root ſending up a ſtalk, upon the top of which grew, inſtead of ſeed, a cluſter of very ſmall onions exactly like the root; each of which put into the ground would increaſe and produce ſuch another bunch of ſmall onions. An account was ordered to be taken of it, none of the like having been ſeen before by any of the members preſent; and the onion was returned.

Mr. PACKER informed the Society, that though a patent had lately been obtained for an engine for grinding and preſſing of cider by the help of cylinders toothing one into another; yet he appealed to their Regiſter, to prove, that he had ſome years before ſuch patent propounded it to the Society: and that the Society had accordingly ordered Mr. SHORTGRAVE to make trial of ſuch indented cylinders.

Upon this much diſcourſe aroſe concerning cider. Mr. PACKER affirmed, that by grinding and preſſing out of the juice of the apple at once, a cider might be made as clear as rock-water, which neither would have any lees, nor turn brown: and that Mr. FETTYPLACE of Batterſea had made ſuch juice, and kept it clear fifteen days: but if the pulp were ſuffered to lie after it were beat ſometime before it be preſſed, the juice would both turn brown, and yield abundance of lees. This was ſuppoſed to come from a kind of putrefaction begun in the fibres of the apples before they were preſſed. Others ſuppoſed it a kind of fermentation; and there was much ſaid to ſhew, that fermentation differs from corruption; and that they were the working of different parts one upon another, and that performed different ways. For it was obſerved, that the ſubſtances, whilſt together in the apple, would rot; but when ſeparate in the juice or liquor, they would ferment. It was wiſhed, that trial might be made, what kind of ſpirit would be produced by diſtillation of mellow apples more than of the green ones and freſh gathered. Dr. GREW affirmed, that odoriferous plants would yield a ſpirit without fermentation. But it was anſwered, that though they yielded an

odoriferous substance, yet that could not properly be called a spirit: at least it was not of the nature of a spirit made by fermention, which was called a vinous or burning spirit. The other odoriferous substance might more properly be called the transpiration or sweat of the plant, very analogous to that of animals, by which they are distinguished one from the other plainly by the smell.

About fining of liquors Sir JOHN HOSKYNS affirmed, that thick and muddy cider may be clarified by very fine strainers. Others remarked, that fish-glew or isinglass dissolved with some of the liquor, and then mingled with it, would do the same thing; as also whites of eggs beaten and broken with some of the cider, and then mingled with the whole.

Mr. HOOKE read a letter, which had been delivered him by Mr. HENSHAW, to whom it was sent by the president, in which Mr. LEEWENHOECK understanding, that Mr. OLDENBURG was dead, desired to know, to whom he might address his letters for the future; inclosing several testimonials of his former experiments, and an account both in Dutch and Latin of some new observations.

The consideration of this was adjourned to the next meeting. And in the mean time Mr. HOOKE was desired to make a microscope after a way, which he proposed as very likely to do as much, if not in the same mannner as that of Mr. LEEWENHOECK.

Mr. HOOKE produced an ephemerides of twelve eclipses of Saturn by the moon, together with the transit of through the sun, and a calculation of eclipses for the two succeeding years; one of which was omitted in HECKER, which was inclosed in a letter to him from of Hamburgh; some copies of which he promised to deliver to some astronomical observers.

Mr. HOOKE related, that had affirmed, that by rasping his apples with a bread grater he was able to make almost a third part more of cider than by the common way. He mentioned likewise an expedient of rasping those apples much easier by help of a cylinder covered with tin plates made of the form of a grater. Mr. PACKER objected, that though by that means a third part more of liquor was obtained, yet the quantity of lees after settling would be so great, that little more clear cider would be made that way than by the common.

November 1. Mr. HENSHAW, vice-president, in the chair,

There were produced a great many exceedingly small and thin pipes of glass of various sizes, some ten times as big as the hair of a man's head; others ten times less. These were made, in order to try a conjecture of Mr. HOOKE propounded to the Society, that the discoveries, affirmed to be made by Mr. LEEWENHOECK, were made by help of viewing with a good microscope such small pipes containing the liquor or water, in which those multitudes of exceedingly small insects or animals wriggling among each other are discovered; for that he alledged, that the said pipes being filled with liquors became themselves as it were magnifying glasses,

glasses, augmenting such bodies, as swim in the said liquor, on those parts of the said pipes, which are farthest from the eye-glass; for the pipes themselves being looked on by the help of a very good microscope, are made very large and conspicuous; and they again augmenting the opposite parts by the refraction on their cylindrical surfaces double the effect of a single microscope, as was very evident. But notwithstanding this there was no discovery made in the liquor, that was made use of, which was only common pump-water, of any such minute animals. It was therefore ordered, that against the next meeting pepper-water should be provided, and some better microscope than that made use of, that the truth of Mr. Leewenhoeck's assertions might, if possible, be experimentally examined, of which he had produced so many testimonies from such, as affirmed themselves to be eye-witnesses.

After this Mr. Leewenhoeck's papers, which had been produced at the preceding meeting, were read; four of which were testimonials of two ministers, a public notary, and other persons of good credit to the number of eight, of the truth of his former assertions concerning the almost incredible number of small animals wriggling in pepper-water; some of whom estimated, that they saw ten thousand, others thirty thousand, others forty-five thousand little animals in a single drop of water as big as a millet-seed. The two other contained an account of some farther observations made by him with his microscope; one written in Dutch, and the other the same translated into Latin by him; the particulars of which were, 1. That the cause of the blackness of Ethiopians is from the constitutions of the pores, that will not admit light. 2. Of young eels found in eels, and of other lesser within those young ones. 3. That the blood of eels consists of small long sharp pipes; whence he conceived to proceed the noxious qualities of eels blood to the eyes. 4. Of the eggs and manner of generation of , their shapes in the eggs, and their manner of exclusion, how he differs from Swammerdam, &c. 5. That he had sent over the attestation of eight several credible persons, who had attested the truth of his assertions.

After the reading of these papers, Mr. Hooke was ordered to return the Society's thanks to Mr. Leewenhoeck, and to endeavour to procure farther discoveries from him by holding correspondence with him. And upon this occasion much discourse arose concerning insects bred in water. Mr. Henshaw affirmed, that he in May had often taken up with a China comb out of standing water great numbers of small insects not visible but by the help of a microscope, which were thereby found to be like a perch.

Sir Christopher Wren affirmed, that he had often seen and taken out of standing water a certain small insect consisting of about twelve rings with horns before and behind, after the manner of earwigs. He remarked also, that, as to the generation of eels, he had near twenty years before, upon the dissecting of eels found them to be viviparous, having several times taken the young ones out alive.

Sir John Hoskyns produced a bottle of stinking sulphureous water, which he

 had

had received from Dr. CARTER, who had a veſſel of it brought from a very ſtrong ſulphureous well at Queen's near Bath, in order to the farther examination thereof. For this purpoſe this, together with a bottle of Willow bridge water formerly brought in by Sir JOHN HOSKYNS, was recommended to the care of Dr. MAPLETOFT, who was deſired to put the ſame in wide veſſels well covered to keep off the duſt, and in a warm air to be ſuffered to corrupt and putrify, and then to be evaporated, to ſee what ſediment would be left. This putrefaction was deſired, in regard, that, as Mr. HENSHAW affirmed, many liquors without putrefaction will wholly evaporate, which after putrefaction will leave a very great ſediment behind; putrefaction, as it were, letting looſe or unlocking the parts one from another.

Mr. HOOKE produced a piece of leather, which he had made in imitation of the impenetrable leather of the French. This was more ſupple than the French leather; and it was judged, that the French had more wax in its compoſition than this now produced; and by the ſmell the French ſeemed to be made of ſome ingredients of a more pleaſing ſmell than this of Mr. HOOKE, which ſmelled more ſtrongly of the boiled ſalad oil and bees-wax boiled together for an hour or two. This leather, though very limber, was found to hold water for ſome time without being wet through: but whether it would hold ſo well as the French, farther trial was to be made; as alſo of ſome other compoſition for ſoaking the ſkins in, that they might ſmell more like thoſe from France.

After this the third experiment was ſhewn by Mr. HOOKE to verify the truth of his former aſſertions concerning the exceedingly great curioſity of the new contrived poiſe for examination of the comparative weight of liquors even to the hundred thouſandth part of their bulk: and it was before the whole Society evidently ſhewn, that the eighth part of a grain would manifeſtly turn that ſcale, and make it preponderate, in which it was put; and ſo move a body, that was about four pounds in weight, either upward or downward. Now there being in four pounds weight 176320 eight parts of a grain, it thence follows, $\frac{1}{176320}$ part of the weight of the water was thereby diſcovered; which is almoſt beyond imagination. And it was farther aſſerted, that this niceneſs might be as much farther augmented, as ſhould be deſired, or was neceſſary for any manner of curious trials, which was done by making the poiſe ſo much larger; and that in ſuch trials, where great quantities of liquors would be troubleſome to obtain, it was demonſtrated how a receptant-veſſel ſhould be contrived, that with ſome ounces of liquor the examination might be made of a poiſe of ten, twenty, or more pounds in weight, even to the accurateneſs of the tenth part of a grain. And to make it evident, that a ſmall alteration of the water would be made ſenſible by this poiſe, about the quantity of two grains of ſalt was put into about two gallons of water; and it was apparent to all the ſpectators, that the poiſe grew very remarkably lighter. The ſame was alſo repeated; and by a ſecond trial with the like effect the ſame was verified. Some further trials would have been made; but it being late, the Society roſe, and left the farther proſecution of theſe experiments to ſome other time.

November

November 8. The Society met at four in the afternoon, and the president being absent, Mr. Henshaw, vice-president, took the chair.

The first thing exhibited was the experiment charged on Mr. Hooke at the last meeting, of examining pepper-water with better microscopes and thinner and small pipes. The fabric of the microscope for holding such pipes was new and more convenient and expeditious for such examinations than the usual forms, consisting wholly of pieces, which slid any ways very easily, and would stand fixed and steady in any posture, and admit light to the object every way: by the comparing of which various ways of inlightening the object one might the more easily and certainly discern the true shape and constitution of any body. But notwithstanding the pepper-mixture was very strong, being made of rain-water and whole black pepper steeped in it for two or three days; and notwithstanding the microscope was much better than that shown at the last meeting; yet nothing of Mr. Leewenhoeck's animals could be seen. Mr. Henshaw conjectured with a good deal of reason, that it was very likely, that it might not now be a proper season for their generations: and he was seconded by other observations, that the insects in water, from which gnats are bred, and such like, were observed to be generated only at certain seasons: and it was farther added, that a person, who had seen these animals in Holland the preceding summer with a microscope of his own, could not within a fortnight past find any such in pepper-water made here.

Dr. Whistler conjectured, that these small imagined creatures might indeed be nothing else than the small particles of the pepper swimming in the water, and no insects. But Dr. Mapletoft answered, that Mr. Leewenhoeck affirmed, that he had shewn them both alive and dead; dead, when he put vinegar to the pepper-water. However Mr. Hooke upon examining the said water in the pipe with a microscope found a vast quantity of small dust of pepper moving up and down in the water.

He then shewed a way of measuring the bigness of any object seen through the microscope, which was by opening the other eye, and seeing some other object with the left eye, whilst the right eye sees the object through the microscope: and it was evident, that a pipe not bigger than a pig's bristle appeared a cylinder of about three inches diameter: and it was suggested, that there was some hope of producing at the next meeting a microscope, that would magnify much more, and make the parts of the object more distinct.

Mr. Hooke produced a second trial, which he had made upon leather, for rendering it impervious to water. This was a piece of washed leather well soaked in a composition of wax and oil of turpentine boiled together. This was found very limber, and yet very close and impervious to water, the water, which was put into it, slipping from it like quicksilver on paper without sinking into or adhering to it. And it was conjectured, that this might perform much the same effect with that of the French invention. Mr. Henshaw conceived, that sperma-ceti, white wax, and pomatum being mixed with the composition abovementioned might consolidate and toughen the said mixture.

Upon reading what discourse had passed in the meeting of October 24, about cider and clarifying liquors, several suggestions were added to the former.

Mr. HENSHAW affirmed, that there was a wine made by the juice flowing from the ripe grapes without expression, which was delicious and very clear, and therefore called *l'oeil de perdrix*, or the patridge-eye; but that it would not last long, but was for present spending, and presently fit for drinking.

Dr. CROUNE gave a description of *vin de goutte* to be much the same.

Mr. HENSHAW affirmed, that most of those small wines, though they were very pleasant at first, yet were not of any long continuance, few of them outlasting Easter: but that those, which were more harsh and unfit for drinking at first, were the lasting wines. These were made so by the bruising and pressing of the stone, and the steeping in them the husk. That it was this steeping of the husk, that gave the redness to clarets; and that the juice of the grape alone without steeping was white and clear.

Dr. CROUNE suggested, that wines clarified with milk, the lees being thereby precipitated, would not keep; but that vintners draw them off for present spending; as also that vintners in   their wines observe to leave in them a flying lee, as they call it, being not perfectly clear, because thereby the wines will drink quicker, and keep better.

Upon mentioning Mr. LEEWENHOECK's observation about the generation of eels and insects, it was related by Sir CHRISTOPHER WREN, that the young eels, which he had formerly taken out of eels, were about the length and bigness of small pins.

Dr. CROUNE affirmed, that he had observed a slow-worm vivaparous:

That carps dissected at Swallowfield near Reading in Berkshire were found to be oviparous; but the eggs with perfect young carps.

Sir CHRISTOPHER WREN said, that he had taken out of a lobster's eggs a lobster perfectly shaped with claws, &c. and that water   dissected at the proper season of the year have young   perfectly formed within them.

Dr. GREW remarked, that silk-worms eggs had the worm within them to be seen through the shell.

Mr. HOOKE affirmed, that he had seen them come out of them alive, and the rest of the shell remaining to stick to the place, where it was first laid.

Mr. HENSHAW observed, that all worms in nuts proceed from without by eating a way into the kernel; which way in a short time closeth up, but leaves behind it a kind of cicatrix. The like was affirmed of the worms in galls, oak-apples,

apples, and feveral other excreffencies of plants. It was obferved, that all have either a hole in them, by which the worm hath eaten its way out; or elfe the worm itfelf may be found in the middle of it.

Dr. CROUNE remarked, that the chicken might be feen formed in the cicatricula of the egg, by the help of the microfcope. He was defired to fhew this, as foon as he could conveniently, at a meeting of the Society. He complaining of the defect of microfcopes for fuch ufes, Mr. HOOKE fuggefted fome farther improvement of that inftrument by making ufe of the convexity of the furface of the liquor itfelf (put upon the plates of Mufcovy glafs) for augmenting the body within the liquor; as alfo for augmenting the body beyond it. The fame might be done by fmall drops of fluids, that fall on the leaf of coleworts or any oiled or greafed furface; as alfo by the fmall drops at the end of fmall pipes, or fticking on fmall threads of glafs or a fingle clue of filk, the faid globular tranfparent bodies being viewed by the help of good microfcopes. Upon this occafion Mr. HOOKE mentioned again his way, which he had formerly acquainted the Society with, of making microfcope-glaffes with fmall drops of glafs made by melting up the ends of threads in the flame of a candle into a globular figure, and then grinding all away upon a flat except a very fmall fegment of the fpherule; and fo made ufe of as of a plane common glafs, either for a fingle or compound microfcope. He was defired to fhew fome fpecimen of this at the next meeting.

Dr. GREW produced a piece of palmetto or cabbage-tree of Barbadoes, confifting of a great number of cylindrical coats inwrapping one another, but loofe from each other. He was defired to examine it, and fee, what information might be learned from it of the nature of vegetables.

Mr. HOOKE promifed to endeavour to procure fome of the wood of that tree from Mr. HART.

Dr. CROUNE, by the recommendation of Mr. BOYLE, propofed Mr. OLIVER HILL as candidate; as Dr. BROWN did Dr. MUNCKHAUSEN, doctor of law and a native of Dantzick; and Mr. HOOKE did Mr. GEORGE ENT, fon of Sir GEORGE ENT.

Upon a difcourfe, which arofe concerning the water-poife, Sir CHRISTOPHER WREN defired, that there might be drawn up a catalogue of experiments, that might be tried with that inftrument; and conceived, that it might be very ufeful alfo for examining of metals; but he did not mention the method of doing this.

Dr. CROUNE made an objection from fome affertions of GALILEO, in his book *De Infidentibus Humido*: but upon difcourfing the matter it was found not to contradict any thing, that was afferted by Mr. HOOKE concerning the fame, but appertained to fome difputes about the quantity of water raifed by the finking of the poife.

November 15. Mr. HENSHAW, vice-prefident, took the chair.

The

The first experiment there exhibited was the pepper-water, which had been made with rain-water and a small quantity of common black pepper put whole into it about nine or ten days before. In this Mr. HOOKE had all the week discovered great numbers of exceedingly small animals swimming to and fro. They appeared of the bigness of a mite through a glass, that magnified about an hundred thousand times in bulk; and consequently it was judged, that they were near an hundred thousand times less than a mite. Their shape was to appearance like a very small clear bubble of an oval or egg form; and the biggest end of this egg-like bubble moved foremost. They were observed to have all manner of motions to and fro in the water; and by all, who saw them, they were verily believed to be animals; and that there could be no fallacy in the appearance. They were seen by Mr. HENSHAW, Sir CHRISTOPHER WREN, Sir JOHN HOSKYNS, Sir JONAS MOORE, Dr. MAPLETOFT, Mr. HILL, Dr. CROUNE, Dr. GREW, Mr. AUBREY, and divers others; so that there was no longer any doubt of Mr. LEEWENHOECK's discovery. Notice was ordered to be taken of this discovery, and further trial was desired to be made upon rain-water alone; and upon rain-water, in which had been steeped, wheat, barley, and other seeds and grains: as also that blood and several other liquors should be after the same manner examined. The shape of the microscope and the manner of examining the * * [u].

At a meeting of the COUNCIL [x],

Mr HENSHAW, Mr. JONAS MOORE, Sir JOHN HOSKYNS, Dr. GREW, and Mr. HOOKE were named a committee of the council for auditing the treasurer's accounts for the year past.

It was ordered, that Sir JOHN HOSKYNS, Mr. HENSHAW, Mr. BOYLE, Mr. HILL, and Mr. HOOKE, or any three of them, be desired to go to the administratrix of Mr. OLDENBURG, and make demand of the books and papers belonging to the Royal Society in her custody, especially those, which were already laid aside and sealed up in a trunk as such: and they were hereby impowered to repay such reasonable charges, as the said administratrix had disbursed on the Society's account; and to give her a discharge for what they should so receive.

November 30. At the anniversary election of the Society,

The eleven members continued of the council were

The lord viscount BROUNCKER,	Mr. HENSHAW,
The lord bishop of Salisbury,	Mr. HILL,
Mr. COLWALL,	Mr. HOSKYNS,

[u] The entry of the minutes of this meeting in the Journal-book, vol. vi. p. 11. breaks off abruptly here: nor is there any entry of the minutes of any following meetings till that of December 6, 1677.

[x] The date of which is omitted in the Council-book, vol. i. p. 282.

Sir

Sir JOHN LOWTHER,
Sir JONAS MOORE,
Dr. WHISTLER,
Sir JOSEPH WILLIAMSON,
Sir CHRISTOPHER WREN.

The ten new ones elected into the council were

THOMAS BARRINGTON, Esq;
Dr. GREW,
HENRY HALL, Esq;
Dr. HOLDER,
Mr. HOOKE,
Mr. CHARLES HOWARD,
Dr. KING,
Dr. WALTER NEEDHAM,
Sir PAUL NEILE,
Sir ROBERT SOUTHWELL.

Out of these the following officers were chosen:

Sir JOSEPH WILLIAMSON, president,
ABRAHAM HILL, Esq; treasurer,
Dr. GREW, } Secretaries.
Mr. HOOKE, }

Three eminent members of the Society died before this anniversary election, HENRY OLDENBURG, Esq; FRANCIS GLISSON, M. D. and FRANCIS VERNON, Esq;

HENRY OLDENBURG, Esq; who sometimes wrote himself Grubbendol, was a native of Bremen in Lower Saxony [y], and for several years agent [z] for that republic in England with the long parliament, and the protector OLIVER CROMWELL. In the year 1656 he went to Oxford for the advantage of prosecuting his studies [a], and in June was entered as a student by the name and title of *Henricus Oldenburg, Bremensis, nobilis Saxo* [b]; at which time he was, according to Mr. WOOD, tutor to HENRY lord O'BRIAN eldest son of HENRY earl of Thomond; as he appears likewise to have been to Mr. RICHARD JONES, son of the lord viscount RANALAGH by CATHARINE sister of Mr. ROBERT BOYLE. He continued at Oxford till April, 1657 [c]; and soon after attended Mr. JONES to Saumur in France [d], where they resided till the end of March, 1658 [e]. They were at Paris in May, 1659, and in March, 1660 [f]; and at Leyden in August, 1661 [g], but returned to England soon after, Mr.

[y] WOOD Fasti Oxon. vol. ii. col. 114.

[z] In the letters to him from MILTON, printed among the *Epist. Familiares* of the latter, *Epist.* 14 and 18, he is stiled *Orator Bremensium*.

[a] MILTON in his letter to him from Westminster, June 25, 1656, *Epist.* 18, has this passage: *Secessum istum tibi, quamvis mihi fraudi sit, tamen quoniam tibi est voluptati, gratulor, tum illam quoque felicitatem animi tui, quem ab urbano vel ambitione vel otio ad sublimium rerum contemplationem tam facile potes attollere. Quid autem secessus ille conferat prætor librorum copiam, nescio; & quos illic nactus et studiorum socios, eos suopte ingenio potius quam disciplina loci tales esse existimem, nisi forte ob desiderium tui iniquior sum isti loco quia te detinet. Ipse interim recte animadvertis nimis illic multos esse, qui suis inanissimis argutiis tam divina quam humana contaminent, ne plane nihil agere videantur dignum tot stipendiis, quibus pessimo publico aluntur. Sed tu ista melius per te sapis.*

[b] WOOD, *ubi supra*.

[c] BOYLE's works, vol. v. p. 299.

[d] Ibid. & MILTONI Epistol. Famil. Epist. 24 & 25.

[e] BOYLE's works, vol. v. p. 301.

[f] Ibid. p. 301, 302.

[g] Dr. WORTHINGTON's letter to Mr. HURTLIT, Sept. 5, 1661, printed among his *Miscellanies*, p. 271.

JONES, on the 11th of September, being admitted into the Society as a fellow, and subscribing the obligation. In the first charter granted to the Society, July 15th, 1662, and in the second, of April 22d, 1663, Mr. OLDENBURG was appointed one of the two secretaries, Dr. WILKINS being the other; which office the former executed till his death. He began to publish the Philosophical Transactions on Monday the 6th of March, 166$\frac{4}{5}$ [h], and continued them to the end of June, 1677, without any intermission except for about four months from July 3d to November 6th, in the year 1665, when the Society was dispersed on account of the plague; during which he staid at his house in Pallmall Westminster, and carried on a correspondence by letters with Mr. BOYLE [i], whose *History of Cold* he was then translating into Latin [k]. The same year SPINOSA began a correspondence with him [l], and several of his letters to Mr. OLDENBURG are printed in his *Opera Posthuma*.

In September 1666 the necessity of his circumstances, and his disappointment in the profit of the sale of the *Philosophical Transactions*, on account both of the late plague and fire of London, made him sollicitous of procuring some place for the support of himself and his family; for which reason he applied to Mr. BOYLE, that he in conjunction with the lord viscount BROUNCKER and Sir ROBERT MORAY would recommend him for the post of Latin secretary to the king, if it should become vacant [m]; upon which application the lord viscount BROUNCKER as well as Mr. BOYLE shewed a great deal of zeal for his interest, which he had neglected for the sake of serving the Society, having declined several advantageous offers of travelling with young noblemen abroad [n].

In 1667, probably in the month of August, he was committed prisoner to the Tower of London; of which he gives the following account in a letter to Mr. BOYLE, dated at London, September 3, 1667 [o], "I was so stifled by the prison-"air, that as soon as I had my inlargement from the Tower, I widened it, and "took it from London into the country, to fan myself for some days in the good "air of Crayford in Kent. Being now returned, and having recovered my sto-"mach, which I had in a manner quite lost, I intend, if God will, to fall to "my old trade, if I have any support to follow it. My late misfortune, I fear, "will much prejudice me, many persons, unacquainted with me, and hearing "me to be a stranger, being apt to derive a suspicion upon me. Not a few "came to the Tower merely to inquire after my crime, and to see the warrant, "in which when they found, that it was for dangerous designs and practices, "they spread it over London, and made others have no good opinion of me. "*Incarcera audacter; semper aliquid adhæret.* Before I went into the country, I "waited on my lord ARLINGTON, kissing the rod. I hope I shall live fully to "satisfy his majesty and all honest Englishmen of my integrity, and of my real "zeal to spend the remainder of my life in doing faithful service to the nation "to the very utmost of my abilities. I have learned, during this commitment,

[h] See above, vol. ii. p. 18.
[i] BOYLE's works, vol. v. p. 332 & *seqq.*
[k] Ibid. p. 332, 336.
[l] Ibid. p. 338, and 341, 342.
[m] Ibid. p. 357.
[n] Ibid. p. 358.
[o] Ibid. p. 364.

" to know my real friends [p]. God Almighty bleſs them, and enable me to " convince them all of my gratitude. Sir, I acknowledge and beg pardon " for the importunities I gave you at the beginning." The ſtraitneſs of his circumſtances obliged him to lay before Mr. BOYLE, in a letter of December 17. following [q], the ſmallneſs of the conſideration, which he had for the many ſervices, which he performed to the Society, his correſpondents foreign and domeſtic being no leſs than thirty at that time, and his income ariſing from the *Philoſophical Tranſactions*, which was never more than forty pounds a year, now falling to thirty-ſix. And in March, 166⅞, Dr. WARD, biſhop of Saliſbury, expreſſed to him great earneſtneſs to ſee him provided for with a recognition for his labours for the Society, which his lordſhip ſaid he would move in the council, being aſhamed for his own part, that he had been ſo long neglected, who had for ſo many years ſpent all his time and pains in the Society's buſineſs, without any conſideration for it [r]. Accordingly on the 27th of April, 1668, he had a preſent made him by the order of the council; and on the 3d of June, 1669, a ſalary of forty pounds a year allowed to him.

In 1671, he publiſhed in 8vo. an Engliſh tranſlation from the Latin original, printed in Italy, of *A Prodromus to a Diſſertation concerning Solids naturally contained within Solids: laying a foundation for the rendering a rational Account both of the frame and the ſeveral Changes of the Maſs of the Earth: as alſo of the various Productions of the ſame: by* NICOLAUS STENO. In 1675 and 1676, he was attacked on account of the *Philoſophical Tranſactions* by Mr. HOOKE, but was juſtified by a declaration of the council of the Society [s]; to which his correſpondences in various parts of the world were of the utmoſt importance. The method, which he uſed, to anſwer the great number of letters, which he received every week on a variety of ſubjects, was to make one letter anſwer another; and never to read a letter before he had pen, ink, and paper ready to anſwer it immediately: ſo that the multitude of them never cloyed him, or lay upon his hands [t]. He died ſuddenly in September, 1677 [u], at Charleton near Greenwich in Kent, and was interred there [x]. His wife, daughter and only child of Mr. JOHN DURY, a divine well known for his attempts to reconcile the Lutherans and Calviniſts, brought him a portion of four hundred pounds [y], and an eſtate in the marſhes of Kent worth ſixty pounds per annum [z]; and died before September, 1666 [a]. At his death he left two children by her, a ſon named RUPERT, from his god-father prince RUPERT; and a daughter SOPHIA [b]; to each of which children he left a paper of excellent admonitions and directions for their conduct in life [c]; as likewiſe a third, intitled,

[p] In a letter to Mr. BOYLE of December 24, 1667, printed in BOYLE's works, vol. v. p. 377. Mr. OLDENBURG mentions, that Dr. SYDENHAM was the only man, that he had heard of, who, " when I, *ſays he*, was ſhut up, thought fit (God " knows without cauſe) to rail againſt me; and " that was ſuch a coward, as afterwards to diſown " it, though undeniable. I confeſs, that with ſo " mean and unmoral a ſpirit I cannot well aſſoci- " ate."

[q] Ibid. p. 375, 376. [r] Ibid. p. 378.

[s] See above.

[t] Dr. LISTER's journey to Paris, p. 78, 79.

[u] Life of the honourable Mr. BOYLE, p. 114, edit London, 1744, 8vo.

[x] WOOD, *ubi ſupra*.

[y] BOYLE's works, vol. v. p. 358.

[z] WOOD, *ubi ſupra*

[a] BOYLE's works, p. 358.

[b] WOOD, *ubi ſupra*.

[c] Thoſe to his daughter are dated Pallmall, October 16, 1672.

Some Considerations left and recommended by H. Oldenburg *to his dear Wife* Doro-Catharina Oldenburg: which several pieces are still extant in manuscript. His son was living in 1717, when the council of the Royal Society, on the 28th of March, ordered him a present of ten guineas, in consideration of his father's services to it. The minutes of the council-book of September 13, 1677, mention Mr. Oldenburg's widow, and those of a subsequent council stile her his administratrix.

Francis Glisson, M. D. was second son of Mr. William Glisson of Rampisham in Dorsetshire, second son of Mr. Walter Glisson of the city of Bristol[d]. He was educated in Gonvil and Caius College in the university of Cambridge, where he took the degrees of batchelor of arts, in 1620, and that of master, in 1624[e], and became fellow of his college. October 25, 1627, he was incorporated master of arts in the university of Oxford; and having taken the degree of doctor of physic in 1634, was afterwards appointed regius professor of physic in that of Cambridge, in the room of Ralph Winterton, M. D. August 1, 1634, he was admitted candidate of the college of physicians in London, and in September 30, the year following, fellow of it, and in 1639 was chosen lecturer of anatomy in it[f]. During the war between the king and parliament he practised physic at Colchester, where he resided during the siege of that town in 1648[g], being an inhabitant of the parish of St. Mary at the Walls[h]; but afterwards removed to London. In 1654, he published in London in 8vo. his *Anatomia Hepatis: cui præmittuntur quædam ad rem anatomicam universe spectantia: & ad calcem operis subjiciuntur nonnulla de lymphæductibus nuper repertis.* This work, which was formed from his lectures read at the College of Physicians, contains a more exact description of the liver and its several vessels, than had been given by any anatomist before: and besides the discovery of the *capsula communis* or *vagina portæ*, and an excellent account of sanguification, acquaints us how by the continual concoction of the blood the bile is necessarily produced and separated from the blood, with the reasons of its bitter taste. In the piece *de Lymphæductibus* subjoined, Dr. Glisson gives an admirable account of them and of the *succus nutritius*, with the manner of its conveyance, and conjectures about the use of the spleen and glands. In 1655, he was chosen one of the elects of the College of Physicians, and afterwards president thereof, in which post he continued several years[i]. He was one of the earliest members of the Royal Society, being proposed February 13, and elected on the 6th of March, 166⁰⁄₁. His *Tractatus de Naturæ substantia energetica, seu de via vitæ naturæ ejusque, tribus primis facultatibus*, was printed at London, 1672, in 4to. as his *Tractatus de Ventriculo & Intestinis: cui præmittitur alius de partibus continentibus in genere, & in specie de iis abdominis*, was at Amsterdam, 1677, in 4to. He published likewise in conjunction with Dr. George Bate and Dr. Ahasuerus Regemorter, the treatise

[d] Wood, Fast. Oxon. vol. i. col. 238, 2d edit. London, 1721.

[e] From the Register of the university of Cambridge.

[f] From the Register of the college of physicians.

[g] The history and antiquities of Colchester: by Philip Morant, M. A. b. 1. p. 63.

[h] Ibid. b. 2. p. 4.

[i] Dr. Goodal's epistle dedicatory to his *Historical Account of the College of Physicians, &c.* edit. London, 1684, in 4to.

de Rachetide sive Morbo puerilo, qui vulgo the rickets *dicitur:* printed at London, 1650, in 8vo. He died in a very advanced age in the parish of St. Brides in London[k], October 14, 1677[l]. Several of his original manuscripts are in the library of Sir HANS SLOANE, Bart. now part of the *British Museum.*

FRANCIS VERNON, Esq; was descended from a good family in Worcestershire, and born near Charing-Cross in the parish of Saint Martin's in the Fields in the city of Westminster about the year 1637. He was educated at Westminster-School, and thence elected to Christ-Church in Oxford, in 1654[m], where he took the degree of batchelor of arts, January 28, 165$\frac{7}{8}$[n], and that of master, July 17, 1660[o]. His abilities in Latin poetry are evident from a poem of his intitled *Oxonium Poema*, printed at Oxford in 1667, in 4to. but incorrectly on account of his absence. He was secretary to Mr. RALPH MONTAGU, afterwards duke of Montagu, when the latter was sent, in 1669, ambassador extraordinary to LEWIS XIV. of France. During his residence in France Mr. VERNON was very serviceable by his correspondence to the Royal Society, to which he was proposed as a candidate by Mr. OLDENBURG on the 24th of April, 1672, and elected on the 22d of the month following, and admitted on the 12th of June upon his return from France. A strong disposition, which he had very early to travelling, led him to undertake a voyage into the east in 1675; whence he wrote a letter to Mr. OLDENBURG, dated January 10th, 167$\frac{5}{6}$, giving a short account of some of his observations in his travels from Venice through Istria, Dalmatia, Greece, and the Archipelago to Smyrna, whence this letter was written, which was soon after published in the *Philosophical Transactions*[p]. In another letter written from Athens to JAMES CRAWFORD, Esq; the English resident at Venice[q], he mentioned, that he had well examined the ruins of the temple of Delphi and all that was remarkable at Thebes, Corinth, Sparta, Athens, &c. and had clambered up most of the mountains celebrated by the antients, as Helicon, Parnassus, &c. That he had spent some time on the banks of the river Alpheus, where he searched with much diligence for the Stadium Olympicum, but could not find any vestiges of it; but that the pleasantness of that river was a sufficient reward for his pains: that Athens had about six thousand inhabitants, and Sparta five thousand; but that at Corinth there was nothing but utter desolation, except the castle, which was of a prodigious bigness, built on a hill above the city, which then scarce deserved the name of a village: that he had particularly observed that place of the isthmus, where a communication between the two seas had been intended to be made: that his fellow-traveller Sir GILES EASTCOURT died on the plains of Solona, as they went to Lepanto, which place Sir GILES could not reach; for his fever growing more violent with an unquenchable thirst, and he having nothing but water to drink, died on the third day after he fell sick. Mr. VERNON's

[k] WOOD, *ubi supra.*

[l] From a MS. note of Dr. WALTER CHARLETON on the list of the members of the college of physicians in the Pharmacopœia Londinens. printed at London, 1677, in fol.

[m] WOOD Athen. Oxon. vol. ii. col. 599.

[n] Id. Fasti Oxon. vol. ii. col. 115.

[o] Id. ibid. col. 128.

[p] Vol. xi. n° 124. p. 575. for April 1676.

[q] Mr. CRAWFORD gave an account of this letter in one to Mr. OLDENBURG, dated at Venice, January 17, 167$\frac{5}{6}$, and inserted in the supplement to the Letter-books, vol. ii. p. 427.

journal

journal of his travels is extant among the papers of the Royal Society, being found among those of Dr. HOOKE, as appears from a letter of Dr. RICHARD MEAD to the Revd. Mr. EDMUND CHESHULL [r]. This journal, which contains only short and imperfect notes, but a great number of inscriptions, begins at Spalatro, July 8, 1675, and ends at Ispahan, September 14, 1676. The advantage, which Mr. VERNON's travels might have been of to the public, was prevented by his unfortunate death near Ispahan in Persia in a contest with some Arabs about an English pen-knife, which he refusing to give them, they fell upon him and cut him to pieces. His body being conveyed to that city was interred there [s].

December 6. Sir JOSEPH WILLIAMSON, president, in the chair.

The minutes of November 22, having been read gave occasion of much discourse concerning the hydrostatical experiment, which had been shewn at that meeting, viz. in order to the clearing of some doubts and answering objections; and further experiments after another method had been made at this meeting, if the apparatus, which was ready, had not been accidentally broken at the sitting down of the Society, which was therefore to be prepared anew against the next meeting.

Mr. HOOKE then shewed two microscopical experiments, which he had promised at the preceding meeting.

The first was a farther improvement of the compound microscope, whereby he shewed those small insects in pepper-water very much more magnified and more clear than they appeared the day before; which was done by making the object-glass of a much smaller sphere than the last, which was viewed by several of the persons present.

The second was a new sort of single microscope, wherewith he exhibited to the president himself, and afterwards to most of the members present, the same little creatures swimming to and fro in the pepper-water contained in the small cane; and made them so visible, that all, who looked through the said microscope, though they had not been accustomed to the use of glasses, yet discovered them so plainly, as to be able to discover their figures, magnitudes, and motions. And all concluded the appearance this way to be much more clear and distinct, than it was the other way by the double microscope, though that was one of the best of that kind.

Mr. HOOKE did not now give a description of his single microscope, as having some farther improvements thereof to exhibit in some of the following meetings, undertaking to make the same to magnify objects a thousand times more than this; though this, considering the clearness, magnified about a thousand times more than the common microscopes. He was desired to prosecute these improvements

[r] Dated Crutched Fryars, July 15, 1709.

[s] WOOD, Athen. Oxon. col. 600.

with

with what expedition he could, and to prepare a letter to Mr. LEEWENHOECK against the next meeting.

Mr. WINDHAM formerly proposed by Sir JOHN HOSKYNS was put to the ballot, and chosen without any negative, there being twenty-four fellows present.

Sir PETER COLLETON was proposed candidate by Sir PETER WYCHE : And,

GEORGE WHEELER, Esq; by Mr. CHARLES HOWARD.

Dr. THOMAS GALE, Dr. ROBERT PLOTT, THOMAS SMITH, B. D. being without, were called in, and having severally read and subscribed the engagement in the Charter-book, were by the president admitted fellows.

Dr. GREW read some parts of a discourse, which he had composed concerning flowers; and shewed the delineation of things taken notice of by him for that purpose.

It was moved, that he would print this discourse; and Dr. WALLIS mentioned, that it was proper to print all of that kind in quarto, that they might be bound together.

A letter from Paris to Mr. BERNARD, and by him communicated to and translated by Mr. HOOKE, was read, containing several remarkable informations concerning philosophical, mechanical, and other subjects of learning [t].

Capt. LANGFORD's paper about hurricanes presented to the Society by Sir ROBERT SOUTHWELL was read, wherein he gave an account, first of the occasion of his coming to the knowledge of foretelling hurricanes; which was his kindness to an Indian, whom he had in his power, and who afterwards died in South * *. Secondly, of the signs and prognostics of hurricanes, and the great benefit, which he had thereby of preserving ships at sea, and goods at land. Thirdly, his conjectures concerning the reasons and causes of these wonderful and violent storms.

Sir ROBERT SOUTHWELL having desired, that the Society would furnish him with some farther queries pertinent to that purpose, Sir JOHN HOSKYNS, Mr. HILL, and Mr. HOOKE, were desired to draw up such as they could think of for that inquiry.

Dr. WALLIS remarked, that in the earthquake, which happened at Oxford in the year 1665, he had observed a very considerable and sudden fall of the baroscope, though he himself did not observe the concurrent accident of the earthquake.

Mr. HOOKE affirmed, that he had for fifteen or sixteen years past constantly

[t] Letter-book, vol. viii. p. 10.

observed

observed the baroscope, and that he had always found, that in the said instrument the quicksilver was always exceedingly low, and fell to that station very suddenly, whenever any considerable storm of wind and rain had happened in that time. And that whenever the quicksilver was observed to fall suddenly very low, it had always been a forerunner of a very great storm suddenly to follow, sometimes within twelve hours; and therefore he hoped, that this instrument might be of very good use at sea, in order to the foreshewing an ensuing storm.

He also mentioned, that he had an hypothesis, by which the phænomena of the baroscope would be more clearly and distinctly made out than by any, which he had hitherto heard of; viz. of dividing and distinguishing the two principles or causes, which actuate the said instrument, from which distinction it would be easy to shew the reason, why at different times the same hight of the quicksilver foreshews different constitutions of the weather.

Dr. WALLIS observed, that it would vary with keeping; but Mr. HOOKE was of a different opinion.

Mr. HOOKE upon this occasion acquainted the president and Society, that he had a baroscope making, which would make the alteration of the pressure of the air as evident, as should be desired; and that instead of two inches or thereabouts, which was the difference, that is usually observed between the highest and lowest altitude of the upper surface of the quicksilver above the lower, he could by this make that difference two feet, or two yards, or two fathoms, or more, if it should for any use be found necessary.

Dr. CROUNE related, that Sir PETER COLLETON had taken care to send several baroscopes to Barbados, in order to examine, whether they would be of any use for the foretelling the seasons and mutations of the weather, as they are found to do in England, especially concerning hurricanes.

Mr. OLIVER HILL made some queries concerning the use of quicksilver and spirit of wine in the making of the baroscope; and it was answered, that quicksilver was made use of by reason of its great weight, and so diminishing that instrument from thirty-five feet to thirty inches: and spirit of wine, by reason both of its easiness and readiness of expansion, and also of its exemption from freezing. But he not thinking these sufficient reasons explained a theory, which he had of their usefulness in that instrument deduced from some chemical principles of his own, whereby he endeavoured to shew the reason of all the appearances.

Mr. ABRAHAM HILL queried, from what cause it was, that the quicksilver and tube being well purged of air, and the experiment being made with great care, the quicksilver had been found to stand to the hight of seventy inches, contrary to the received theory of the gravitation of the air.

To which Mr. HOOKE answered, that though by such diligence and care as he had mentioned, he had made the quicksilver to stand at that hight; yet even then,

then, if any confiderable jog or fhake were given to the tube, in which the quickfilver was fufpended, the quickfilver would leave the top of the tube, and fall to the hight of thirty inches, or thereabouts, according as the ftandard of the quickfilver was at that time: and he added, that this fecond fufpenfe depended upon a fecond caufe, which he had formerly explained in a difcourfe to the Society.

Mention was made, that Dr. WALLIS had formerly faid fomething on this fubject; and it was defired, that inquiry might be made concerning it.

The prefident inquiring what experiments were defigned for the next meeting, Mr. HOOKE undertook to have the hydroftatical experiment ready; as alfo a farther improvement of the microfcope.

It being late, the Society rofe, and waited on the prefident to his own houfe.

December 13. The prefident in the chair.

Mr. BARRINGTON and Mr. HALL were fworn of the council.

Dr. GREW was fworn fecretary.

Sir PETER COLLETON was elected by the fuffrages of twenty-fix members without a negative.

JOHN HERBERT, Efq; propofed candidate at the laft meeting by Dr. WHISTLER, was elected.

The minutes of the laft meeting were read; whereupon a debate arofe concerning the caufe of the phænomena of the barometer: and whether the fame hight of the quickfilver always forefhews the fame conftitution of weather.

Dr HOLDER related, that Dr. VOSSIUS had endeavoured to give a reafon of of thofe appearances from the different natures of the air blowing from the fea or from the land; and that the former were light and the latter heavy.

Mr. HOOKE explained the manner how the air at fometimes preffed more, fometimes lefs; and that was from the real accefs and accretion of vapours raifed up in the form of air; which, whilft intimately mixed with the air, might augment the bulk, as alfo the fpecific gravity of the air fo long, till by a fecond fort of vapours all thofe others become precipitated or condenfed into the form of water, whereby the air, out of which they are feparated, become lighter in fpecie; and alfo the altitude of the aereal cylinder becomes lower: for the gravitation of any fluid upon an equal bottom of the containing veffel is always in a proportion compounded of the fpecific gravity of the fluid itfelf; and fecondly, of the perpendicular altitude of the faid gravitating fluids. This he affirmed he had made out formerly to the Society by many experiments, as their Journal-book would fhew.

To this Sir JONAS MOORE agreed, and explained the ſame in a tun filled with liquor, wherein the gravitation or preſſure againſt the bottom, or any part thereof, was always equal to the weight of a cylinder, equal to the bottom of that liquor, where it touches the body.

Upon this Dr. WHISTLER made ſeveral objections; but upon the farther explication of the manner of making the experiments, he was ſatisfied with the theory.

Dr. GREW alledged, that he had formerly propoſed a theory of his own, of explaining the preſſure of the air by the diſſolution of ſalts, wherein his ſuppoſition was, that the ſaid ſalts before diſſolution weighed more (that is, augmented the preſſure of the air) and after diſſolution leſs (that is, diminiſhed the preſſure of the air.) This was not debated, becauſe he promiſed to bring in his theory, as he had formerly read it in the Society, at the next meeting.

Whilſt this was diſcourſing, Mr. WHEELER was put to the ballot, and elected by the ſuffrages of thirty members without a negative.

Sir JONAS MOORE related, that Mr. TOWNLEY had made obſervations of the barometer at Townley in Lancaſhire for ſeveral years, and that the ſame alterations had happened, which at the ſame time had been obſerved at London.

He remarked likewiſe, that he had himſelf obſerved the ſame at Tangier for a whole year, and had not found the difference of altitude more than one inch all that time in that place; whence the greater conſtancy of the weather of that place was argued, and that the preſſure of the air was not the ſame in all parts of the earth, but in ſome places always more, in ſome always leſs.

Sir CHRISTOPHER WREN, upon the diſcourſing of the various preſſure of the ſea and land-winds, propounded Bermudas as a very convenient place to have trials made of the mutations of the barometer, the ſeaſons there being very temperate, and the iſland lying encompaſſed on every ſide with the ſea, and very far from any land.

Mr. HOOKE related, that he had been informed by Sir JONAS MOORE, that obſervations were then making in another iſland more conveniently ſituated for that purpoſe, viz. in St. Helena, on the other ſide of the line.

Sir JONAS MOORE confirmed this; and added, that the hight of the mercurial cylinder there had not exceeded ſix inches.

The preſident thought upon the whole matter, that it was very proper, that obſervations of this kind ſhould be made in as many parts of the world as could be procured; and that all experiments of this kind whereſoever made, and by whatſoever contrivance, whether by mercury, water, or any other liquor, and whether by a plain or a wheel barometer, or by any other more compounded, inſtrument

ment invented for that purpose, should be reduced to one standard of inches and parts: and that, together with such observations, care should be taken to observe and register the various constitutions and mutations of the air, that happen at those places; viz. the quarter and strength of the wind, the transparency and opacity of the air; as also its present constitution as to heat and cold, dryness and moisture, cloudiness and clearness, and the like; that so from the comparing of these several observations together, a theory might be made of the said mutations grounded upon observations and experience, the sure guides in all inquiries of this nature.

And whereas Mr. Hooke had read in the minutes of the last meeting, that he had contrived a barometer, by which an infinite number of small mutations of the air might be discovered, which would be wholly invisible, and insensible by the more common air-poises, the president advised him, that whatever the contrivance was, he should reduce it to a certain standard of inches and parts, as decimal, centesimal, or thousandth parts of inches.

Upon this it was affirmed, that Sir Jonas Moore had kept an account for some time of these mutations; as Mr. Townley had also done for a longer time.

Dr. Croune affirmed, that he had also made some observations of this kind, and kept an account thereof.

The like was affirmed by Mr. Hooke.

It was likewise asserted, that Dr. Wallis, and several other members of the Society had done the like; which observations, it was hoped, would in time be all collected into the registers of the Society as the proper place, where all matters of this kind might be kept upon record.

Mr. Oliver Hill thought, that it was going very much about to begin with experiments and with theory, and affirmed, that he had, upon what had passed at the last meeting made several animadversions, whereby he had, from a theory, of which he was master, of the nature of the air and of mercury, and from principles of his own invention, plainly shewed the reason of all the experiments, which had been exhibited and discoursed at that meeting, and why things happened so and not otherwise; and that by his said theory, he could not only explain those there produced, but all others whatsoever of that kind; particularly those about the animals in pepper-water, and the experiments of the water-poises: and that, if the Society thought fit, he would, at the next meeting, bring in and read his said animadversions and theories: which the president desired him to do, although he was acquainted, that the method and business of the Society were very different from those which he propounded; it being their aim rather to be directed by the operations of nature, duly observed, than by theories not built upon a sufficient and unquestionable foundation of observations and experiments.

Mr. HOOKE then ſhewed the experiments appointed for this meeting; and the firſt was an improvement of the ſingle microſcopes, by which the little animals were exhibited much more magnified and very much plainer, though to ſome perſons they ſeemed not ſo plain; the reaſon of which was to be aſcribed to ſome otherwiſe imperceptible defects of the eye.

His ſecond experiment was of a water-poiſe, whereby the difference of the ſpecific gravity of liquors was manifeſted by the ſinking of the neck of a poiſe into the fluid examined, not at all making uſe of ſcales, as in the former experiments. And the niceneſs and curioſity of this inſtrument was ſhewn to proceed from the very great difference between the bulk of the poiſe under the fluid, and the ſmallneſs of the ſenſible part of the neck, which might be made as one thouſand, or ten thouſand, or an hundred thouſand to one; and conſequently that the difference or alteration of the ſpecific gravity of any liquor examined thereby might be diſcovered, though it were altered but 1,000, or 10,000, or 100,000 part of it.

Dr. CROUNE conceived, that the ſame thing might be diſcovered by the help of a large beam weighing a great quantity of ſuch a fluid. But it was ſhewn, that it was wholly impoſſible to come any thing near that exactneſs with any ſuch beam, though ever ſo curiouſly made, becauſe the great weights, that muſt be put into the ſcales of the ſaid balance, would, if the edges of the middle pin of the beam were very ſharp, not only flatten them, but ſink an impreſſion into the holes thereof; and that whereas half an ounce poſſibly would be requiſite to turn the moſt exact beam, when charged with two hundred weight at an end, in this half a grain would produce the ſame effect.

Dr. CROUNE alſo urged, that this was the ſame with the common water-poiſe. But Mr. HOOKE ſhewed wherein it differed; namely, that whereas the moſt exact of that kind, that he had hitherto ſeen, would not diſtinguiſh to a much ſmaller quantity than about an hundredth part of the bulk, this would do to an hundred thouſandth; which was a thouſand more exact. And, ſecondly, that whereas that did it only indeterminately, and without any reſpect to the ſpecific gravity by uncertain diviſions; this was deſigned to define and determine that alſo, by giving the proportion, that the ſaid alteration had to the whole.

This was the third inſtrument of this kind, which had been produced to the Society by Mr. HOOKE. And the reaſon, which he gave of his ſo doing, was, that it was not his deſign or intention to load or trouble the Society at their meetings with a confuſed enumeration of experiments of one kind, which might be made with every one of the ſaid inſtrument; that being only the work of a labourer or operator to perform, when once the inſtruments were contrived, and the method chalked out. But his deſign was rather to improve and increaſe the diſtinguiſhing faculties of the ſenſes, not only in order to reduce theſe things, which are already ſenſible to our organs unaſſiſted, to number, weight, and meaſure, but alſo in order to the inlarging the limits of their power, ſo as to be able to do the ſame things in regions of matter hitherto inacceſſible, impenetrable, and imperceptible by the ſenſes unaſſiſted. Becauſe this, as it inlarges the empire of

of the ſenſes, ſo it beſieges and ſtraitens the receſſes of nature: and the uſe of theſe, well plied, though but by the hands of the common ſoldier, will in a ſhort time force nature to yield even the moſt inacceſſible fortreſs.

And of this kind were all thoſe inſtruments, which he had ſince the laſt meeting of the Society endeavoured to explain and ſhew to them. Such were the microſcopes, which he had there exhibited, which would as much exceed the common ones, as they did the naked eye; and conſequently were an improvement of that ſenſe, which is the moſt ſpiritual of all the five. Such were the water-poiſes newly explained: and ſuch was the barometer, which he was now preparing; for that thereby multitudes of mutations of the preſſure of the air, which were wholly imperceptible to the common barometer, would by it be diſcovered. And to ſhew, that this was not purely conjectural, he affirmed, that by an inſtrument of this kind he had diſcovered ſuch mutations and motions in the atmoſphere, as were very ſurpriſing and very ſignificant; ſuch as the tremulous motion of the ſaid barometer before a great ſtorm enſuing, which could in no reſpect be aſſigned to any ſhaking of the houſe from wind, or the paſſage of carriages near the place, which was purpoſely taken notice of.

The experiment propounded by Mr. Hooke for the next meeting was in order to explain the phænomena of the gravitation of the air, and the differences thereof cauſed by the riſing of vapours from the earth; concerning which he affirmed, that he had ſhewn ſeveral experiments, and he ſuppoſed, that they were in the Regiſter-books of the Society: but notwithſtanding there having been much debate concerning that matter, and ſeveral perſons there preſent not being well ſatiſfied concerning the manner, reaſons, and ſignification thereof; it was judged convenient, that it ſhould be prepared by the operator.

December 19. At a meeting of the Council were preſent

Sir Joseph Williamson, preſident,

Sir John Lowther,
Sir Paul Neile,
Sir Robert Southwell,
Sir Christopher Wren,
Sir Jonas Moore,
Sir John Hoskyns,
Mr. Charles Howard,
Dr. Holder,
Dr. Whistler,
Dr. King,
Mr. Henshaw,
Mr. Hill
Mr. Hall,
Dr. Grew,
Dr. Walter Needham,
Mr. Colwall,
Mr. Hooke.

It was ordered, that what experiments ſhall be undertaken by the curators ſhall be propounded a fortnight before the ſhewing thereof, that objections, anſwers, and confirmations may be timely thought of: and

That the curators or any other perſon ſhewing an experiment to the Society ſhall explain the ſame, and ſhew the deſign and uſefulneſs of it.

I A de-

A debate about making collections out of the Regifter and Journal-books, in order to print them, was ordered to be refumed, when the papers and books are recovered by the Society.

Both the fecretaries were ordered to be employed in taking the minutes at the meetings; but thefe minutes to be drawn up fair for the amanuenfis to enter by one, who is alfo to read them.

It was ordered, that a common letter be drawn up by the fecretaries againft the next meeting of the council: that all letters to the fecretaries be for the future inclofed in a paper to the prefident, Sir JOSEPH WILLIAMSON, his majefty's principal fecretary of ftate: and

That all letters received be pafted into a book, as they are received; and that fuch of them as fhall be thought fit, fhall be fairly copied out into the Letter-book for that year.

December 20. Mr. HENSHAW, vice-prefident, in the chair.

The minutes of the meeting of the 13th inftant were read; and the vice-prefident defired, that the experiment of the fmall animals in pepper-water might be fhewn to the lord HALIFAX [a], then prefent, who plainly difcovered them fwimming up and down in the liquor.

Mr. OLIVER HILL was called upon for his difcourfe, which he had promifed at the laft meeting, upon feveral matters, that had been fhewn to the Society: to which he made an apology, for his not bringing in his thoughts of the baroscope, by reafon that he could not obtain what obfervations had been made by Dr. WALLIS and others, which he had called for of Mr. HOOKE, but they were not in his cuftody. He made fome objections to what was entered as his fenfe at the laft meeting; and faid, that though he did maintain, that we ought to be ruled by a theory in the making all our experiments, yet he would be underftood to have the theory founded upon previous experiments. Upon fuch a theory as this he affirmed to have found the caufe of the little animals abovementioned; and that was, that the fkin of the pepper being very porous, and full of fmall * * was the caufe of the receiving the fpirit of the air, which is there as in matrixes, and by the heat and drynefs of pepper hatched into animalcules: that thefe little creatures were actually alive in the pores of the fkin of the black pepper; and that they were by water to be wafhed off from the furface of them. When it was objected, that it did not feem fo probable, that thefe animals fhould be in the pores of the fkin of the pepper, fince it had been obferved, that creatures not much unlike had been found in the fteeping of oats, wheat, barley, peafe, and divers fteepings, and even in rain-water itfelf, he affirmed, that the fame principles would make it out; for wherever there was a fit matter, the fpirit would operate, and produce an animal.

[a] Sir GEORGE SAVILE.

The

The vice-president alledged, that REDI had found particular animals adherent to particular bodies; whence it was probable, that these animals, if they had been produced by the pepper, would not have been produced in these other waters, in which oats, wheat, barley, &c. had been steeped: and therefore it was more probable, that these little creatures were originally in the water; and that the infusion of black pepper had only afforded them a better food, wherein they increased more plentifully; and that their seeds or eggs were disposed in the water, and not in the pepper.

To this Mr. OLIVER HILL replied, that there was no need of any such thing as a seed or egg, since there was a spirit of nature, which was every where; and where it found fit matter to work upon, there it produced an animal.

When it was objected, that there had never yet been any certain experiment or observation of the production of an animal, where there might not be shewn very good reason to believe, that there was a seed or egg for its cause: he answered, that he could easily shew an experiment, that would plainly confute that assertion; which was, that he could take May dew, and put it into a glass, and seal it up hermetically; and then by ordering the glass in such a way, as he well knew, he could in time produce therein an animal six inches long; which should continue to grow to that bigness, and that the said animal should in longer decay and vanish again.

And when it was enquired of him, whether he could do it with May dew distilled, he said not; because that was spirit of May dew, and not May dew.

The vice-president observed, that he had formerly had a creature produced in May dew; but that the glass was neither stopped nor hermetically sealed; but that it was rather supposed, that it had come in by the mouth of the glass. He added, that May dew might well be supposed to be a body full of the seeds of living creatures, since it was gathered at a proper time of the year, upon wheat and other vegetables; and since the animal could not be produced, when any operation had been done upon the said dew, that might destroy the seminal principles swimming in it, as Mr. OLIVER HILL had before confessed, that there could be no conclusion drawn from that argument.

When Mr. OLIVER HILL farther urged, that he would shew an experiment, that he could, by washing black pepper with distilled water, wash out the said animals from their cells in the rine of the pepper: it was desired, that he would against the next meeting provide some such pepper and such water, as should be needful, though it was believed, that the effect would in no wise follow such an operation.

After this discourse, Mr. OLIVER HILL read a written discourse of his, about the method, which the Society ought to take in their proceedings, much different from what they then followed.

Mr.

Mr. George Ent presented the Society with the printed catalogue of the Bodleian library.

Mr. Hooke shewed an hydrostatical experiment mentioned at the last meeting, which was in order to explain how the mutations of the baroscope were occasioned by the different pressure of the air; which pressure was sometimes greater, sometimes less, according as the exhalations or vapours raised up into the same augment the specific gravity of it, and the bulk also or perpendicular altitude thereof. This he made appear by means of a very high body of glass filled with water, into which was let down a standard of pressure made by a bended tube of glass, in which mercury was put; which, as it descended deeper into the water, and consequently the pressure encreased, was raised on one leg, and depressed in the other leg thereof. Then a bladder was tied to the end of another glass-cane, and by the breath, after it was sunk down into the water, was blown up; by which the fluid was increased, though not the specific gravity; and thereby the perpendicular altitude of the pressing fluid was increased, and consequently the pressure upon the mercury in the standard. The same was verified by a farther trial made with a large bottle of quicksilver close stopped and let down into the body of the said water: and it was alledged by Mr. Hooke, that the same effects would follow from whatever body it were, that was thus put into the fluid, and augmented the bulk thereof, without at all altering the specific gravity of the same.

Dr. Croune remarked, that the same liquor, by being put into different cylinders, and so different postures, much augmented the pressure of the same quantity of fluid upon the respective bottoms.

But Mr. Hooke observed, that the same quantity of a fluid body, by being put into ever so much different cylinders, the whole pressure of the said fluid upon the whole bottom of the one would be equal to the whole pressure of the other upon the whole bottom of the second; because the gravity of the fluid must be the same in all postures, and the space possessed by the same would also be equal; for as the base of the bigger is to the base of the less, so the perpendicular altitude of the less is to the perpendicular altitude of the bigger.

To this Dr. Croune could not assent, but alledged, that he would make out the contrary by experiment.

The experiments propounded by Mr. Hooke for the next meeting were the prosecution of the hydrostatical experiment, and a farther improvement of the microscope.

The Society then adjourned on account of the approaching festival to Thursday January 3.

$167\frac{7}{8}$, *January* 2. At a meeting of the Council were present

Sir Joseph Williamson, president,

Sir

Sir John Lowther,
Sir John Hoskyns,
Sir Paul Neile,
Sir Christopher Wren,
Sir Robert Southwell,
Mr. Charles Howard,
Mr. Henshaw,
Mr. Hill,
Dr. Holder,
Dr. Whistler,
Dr. King.

It was ordered, that the former committee be deſired to viſit Mr. Boyle, and to deſire his aſſiſtance in recovering the books and papers of the Society yet remaining in Mrs Larden's hands [b]: and

That care be taken to have the oaths of Dr. Pell and the adminiſtratrix made in chancery, that all the papers belonging to the Society had been delivered; and that they knew of none elſe.

The common letter to be ſent to all the correſpondents was read, and altered; and ſomewhat of return for encouragement of the correſpondence was ordered to be added.

The correſpondents named were, Malpighi, Huygens, Justel, Carcavi, Slusius, Henelius, P. Lana, Bullialdua, Stuzout, Leibnitz, Sir William Petty, Mr. Lister, and Mr. Newton.

It was ordered, that all letters received by the ſecretaries ſhould be produced at the next weekly meeting; and if the Society ſhould think fit, be read; and that that the ſecretaries take the directions of the Society for the ſpeedy anſwering them, at leaſt ſo far as to the acknowledging the receit: and

That Dr. Robert Plot, in conſideration of the promiſe he hath made the Society, in accommodating them with natural curioſities, and accounts of ſuch other particulars, as would be pertinent to their deſign, which he might meet with in his ſurvey of England, be excuſed from his weekly payments.

Mr. Henry Hunt, the operator, was appointed the treaſurer's deputy to receive ſuch arrears of the members, as he ſhould receive directions from the treaſurer ſo do from time to time:

It was ordered, that all acts of the council be entered fairly into the council-book:

That there be prepared once a-year a collection of all ſuch matters, as have been handled that year, concerning four, five, or more ſubjects, which have been well proſecuted, and completed; which may be printed in the name of the Society againſt the anniverſary election-day:

[b] Mr. Hooke, in a letter to Mr. Lister, 5th January, 167$\frac{7}{8}$, (Supplement to Letter-books, vol. iv. p. 369) obſerves, that all the papers of the Society could not yet be retrieved from Mr. Oldenburg's executrix's cuſtody.

That the Register-books of the Society be perused; and that what shall be thought fit by the council to be published, be drawn out and printed accordingly: and

That lists of the several persons in arrear to the Society, and of their respective arrears, recommended to several of the council, be made and delivered to them as a memorandum of what they had undertaken.

January 3. At a meeting of the SOCIETY,

Mr. HENSHAW, vice-president, in the chair.

Mr. WHEELER was admitted fellow.

The minutes of December 20 were read; which occasioned much discourse concerning the constitution of the air as to its transparency and opacity, gravity and pressure, fogs, mists, rains and wind; concerning which it was debated, whether an opake, foggy, or misty air were heavier than a clear transparent air; and it was concluded, that the transparency or opacity of the air does not at all contribute to the gravity or pressure thereof; though on the other side the extraordinary gravity of it might sometimes be the cause of its opacity. And the reason was alledged, because sometimes, when the pressure of the air hath been greatest, it hath been observed, that the air hath been as transparent and clear as at any other time whatsoever; and at other times, when the air hath been exceedingly light, fogs and mists have been taken notice of: and that it was supposed, that the transparency and opacity of the air proceeded only from the uniformity of the parts of the air, and the opacity from the difformity and incongruity of them. That it was thus explained by Mr. HOOKE, that the æther, which incompasses the earth, is the grand or universal menstruum, which dissolved takes up into itself, and suspends all sorts of vapours and exhalations whatsoever; viz. all those bodies in the atmosphere, which make up or constitute that body, which hath a very great springiness in it; and which will not pervade the pores of glass, but can be confined and included by it, much after the same manner as water dissolves salt, sugar, or the like into itself, and keeps it suspended and intimately mixed with it, that so long as the vapours and exhalations remain thus dissolved and perfectly mixed and united with it, they appear perfectly transparent. But when, by the mixture of different sorts of vapours they either unite with them, and leave the æther; or those other being more congruous to the æther unite and coalesce with, and jostle out these, and so make them a distinct body, these vapours or exhalations become as it were opake; that is, though really they are *in minimis* as transparent as formerly, yet by being disunited with the air, and having a different refraction, they make the air seem opake and foggy. That these changes are often wrought from transparency to opacity, and from opacity to transparency; and yet the gravitation of the air not at all altered, by reason, that the same bodies remain suspended in the same part of the atmosphere; and consequently their gravitation cannot be at all taken away. And whereas the vice-president objected, that what was alledged was but hypothetical; and that it was not very evident,

that

that there was any such thing as an æther, much less was it understood what it was, and what properties it had; or that the air consisted of such parts, as was alledged; Mr. HOOKE answered, that by multitudes of experiments he could make it very evident, first, that there was such a body: secondly, what many of the properties of that body were: thirdly, how very considerable and powerful those properties were in producing multitudes of effects ascribed to other causes generally: fourthly, how those properties might be examined and assayed and reduced to a standard, viz. to number, weight, and measure; and consequently, that he could make it a subject fit to be farther inquired into by the Society, whose business it is to be directed by the great schoolmistress of reason, experience; and not to be ruled by groundless fancies and conceits.

By these ways he explained the phænomena of the great gravity of the air upon the long blowing of an eastwardly, and the lightness of it upon the blowing of a southwardly wind; the air in the one coming over a vast tract of land, and so taking up into itself great quantities of exhalations, which remain suspended and mixt with it by reason of their congruity; and the other blowing over a great space of sea, which affords a less quantity of parts disposed to make air.

He also farther explained the reason of the ready converting of vapours into water by the cold of the air, those watery parts being more easily precipitated or separated from the air by the want of heat to keep them agitated; as was instanced in the appearing of one's breath in cold weather, and the easy conversion of the wind produced by water heated in an Æolopile into water again by the want of that heat and agitation.

Wherefore the gravity of the air arising only from the quality of those gravitating parts, which were suspended in the form of air, the greater the one is, the greater also must consequently be the other.

Mr. OLIVER HILL then coming in affirmed, that there was no such thing as gravity in the air; but that air was positively light; and that all, who believed otherwise, were mistaken, and in a great error, as he would presently make appear both by reasons and experiments; and to this purpose alledged many things, which he affirmed he had more at large explained and better digested in a discourse, which he had then about him on that subject; and that he had drawn it up on purpose for that meeting; and that he would read it, if the Society thought fit, and continue those his discourses, if they met with entertainment worthy of them.

After which he read his paper, a copy of which he promised to deliver to the secretary, between that and the next meeting, that an account thereof might be taken by the secretary.

At the same time also he delivered in a copy of his discourse, which he had made at the last meeting, about the worms in pepper-water; intitled, *Reflections on the Transactions of the Royal Society in their meeting on Thursday, December 6, 1677.*

 Sir

Sir JAMES LANGHAM was propoſed candidate by Mr. HORNECK:

And Dr. THEODORE KERCKRINGIUS by the vice-preſident at the deſire of the preſident.

Mr. HOOKE acquainted the Society, that he had met with a diſcourſe of optics newly publiſhed by Pere CHERUBIN, containing deſcriptions of ſeveral ſorts of binocular teleſcopes and microſcopes; and of an inſtrument of taking the figure of things at a diſtance by the help of a teleſcope. He was ordered to procure that book for the Society's library.

The epitome of ſix papers from Mr. HEVELIUS to the ſecretary was read. The firſt marked A, was a letter about ſeveral particulars.

The ſecond marked B, contained an account of the occultation of Saturn by the moon, which he would have obſerved, but that the weather prevented him [c].

C was concerning the tranſit of Mercury through the ſun [d].

D a catalogue of the diſtances and poſitions of Saturn to the moon.

E a ſcheme or draught of the ſame obſerved through a twelve and twenty foot teleſcope.

F farther obſervations of the changes of the ſtar *in Collo Ceti* continued to December 6. 1677. N. S [e].

Part of a letter of Dr. SWAMMERDAM to Mr. OLDENBURG, dated at Amſterdam, 10th September, 1677 [f], was read, containing an account of a diſcovery made by him of a ſort of ſnails, that are viviparous.

January 10. Sir CHRISTOPHER WREN, vice-preſident, in the chair.

The minutes of the laſt meeting were read: upon which a diſcourſe aroſe concerning the æther, which Mr. HOOKE affirmed to be the menſtruum, vehicle, or moſt fluid part of the air, into which the exhalations or vapours, which compoſe the atmoſphere, are diſſolved or taken up, after the ſame manner as ſalt, ſugar, or any other tinging body, are diſſolved or taken up by water or other diſſolving liquors.

That the atmoſphere or air, that gravitates on the quickſilver in the barometer, is only that part, which was thus diſſolved and taken up; and that the other part or æther readily and freely pervades the parts of glaſs; whence glaſs becomes as

[c] Letter-book, vol. viii. p. 12, 15, and 18.
[d] Ibid. p. 15, 18.
[e] Ibid. p. 25.
[f] Ibid. p. 2.

it were a ſtrainer to ſeparate between the æther and the groſs parts of air. That according to the quantity of theſe vapours or exhalations raiſed up and ſuſpended thus by the æther in the atmoſphere, ſo was the preſſure of it upon the mercury in the barometer: that the rarefaction and condenſation of theſe vapours did not at all alter the preſſure, provided the ſame quantity of the ſaid vapours were in both the ſaid conditions the ſame.

The vice-preſident doubted, whether there were any ſuch thing as that æther, which Mr. Hooke had hypothetically ſuppoſed; and ſaid, that he would gladly ſee ſome experiment, that would make it evident, that there is ſuch a body mixed with the air.

To this Mr. Hooke replied, that he could by hundreds of experiments evidence the reality of ſuch a body; and that from theſe experiments he was able to collect the ſeveral properties of that body; and how many and how very conſiderable effects it produced in bodies. He farther added, that he had a catalogue of ſuch experiments, which he thought he ſhould have occaſion ſhortly to make in order to the elucidating a theory, which he deſigned to make public hereafter.

The vice-preſident farther inquired, whether the dryneſs or moiſture of the air did not cauſe an alteration of the gravitating power upon the earth.

Mr. Hooke, in anſwer to this, affirmed, that the dryneſs or moiſture of the air contributed not at all to the gravity or levity thereof; but only the greater or leſs quantity of the vapours held ſuſpended by the æther in that form; and that whether it were in perfect air, or condenſed into ſmall globules of water, which yet remained ſuſpended, it was the ſame thing, provided they remained ſuſpended.

He farther added an explication of what he meant by air ſaid to be lighter or heavier *in ſpecie*, viz. that that air, which had a greater quantity of exhalation in the ſame extenſion was the air, that was heavier *in ſpecie*, and that, which had a leſs quantity, a lighter *in ſpecie*: and that the condenſation or rarefaction of the air added not at all, nor took from its gravity, the ſame quantity of exhalations in the whole cylinder.

The vice-preſident inquired farther, whether the air could be made heavier *in ſpecie* by any other cauſe than cold? To which Mr. Hooke anſwered, that not only forcible condenſation, but ſeveral fumes, ſmokes, and vapours, which may be raiſed up into the air, may produce that effect; but that it is very difficult to make it ſenſible by the barometer [g].

January 17. The preſident in the chair.

[g] The reſt of the minutes of this meeting were omitted in the Journal-book, vol. vi. p. 37, 38. where a blank is left, which cannot be ſupplied, as the original minutes are not extant.

The

The minutes of the laſt meeting were read; to ſome parts of which ſome amendments were deſired, viz.

Dr. Walter Needham, upon the mention of worms found in the heads and brains of ſome creatures, added, that thoſe were not found any where in the head, but in the cavities of the os frontis, which in ſheep and kine extends under the horns. Dr. Grew affirmed the ſame from his own obſervations.

Sir John Hoskyns remarked, that he knew a perſon, who by looking upon the wheat, whilſt in the blade, knew, which would prove ſmutty, and which not; and it was ſuggeſted, that Dr. Plot had a theory of that accident, by which he knew how to prevent it in the choice of his ſeed before ſowing.

Upon ſome farther diſcourſes about the barometer Mr. Hooke ſuggeſted, that he had already brought in and ſhewed the Society ſeveral of his experiments, in order to elucidate a theory, which he had on that ſubject; and that he had as yet divers others behind, which he deſigned, as faſt as conveniently he could, to bring in likewiſe; and when they had been all ſhewn, to ſet down the theory of that matter, as he had conceived it.

Mr. Oliver Hill affirmed, that the experiment, which upon trial at the laſt meeting had not ſucceeded, by reaſon, as he ſaid, that the air was then moiſt and foggy, and conſequently, according to his notion, had no elaſticity, upon his making trial of it ſince, had ſucceeded as he expected.

Sir James Langham and Dr. Kerckringius were elected into the Society.

Walter Chetwynd, Eſq; was propoſed candidate by the preſident:

Joseph Lane, Eſq; by Mr. Hooke:

George Ent, Eſq; by Foster:

Edmund Dickenson, M. D. by Dr. King: And,

Francis Aston, Eſq; by Dr. Brown.

Mr. Hooke produced a letter from Mr. Leewenhoeck, mentioned by him at the laſt meeting to have been received; part of which being tranſlated from Dutch into Engliſh was now read by Mr. Hooke, containing Mr. Leewenhoeck's thanks to the Society for their ſo kind acceptance of his laſt communications, and his compliance with their invitation ſent him by Mr. Hooke to communicate ſuch other diſcoveries, as he ſhould make, viz. a farther account of divers obſervations made by him with his microſcope ſince his laſt letter of 2d January, 1676, N. S which he had ſent to the lord viſcount Brouncker, concerning the receit of which he was very ſolicitous to be informed. He informed the

Society in this last letter of his farther observations on milk, phlegm, &c. [h]; and that those pipes formerly mentioned by them were found in his own as well as in eels blood: that the globules of the blood contained six lesser within them; that both the one and the other were extensible into a great length, and would afterwards return into a globular form: that the greater were all of equal size; but the globules of milk were all of different magnitude, some smaller, some greater. He mentioned also an experiment of Dr. DE GRAAFF of injecting milk into the veins of a dog, and explained the whiteness of milk by a sort of milky substance made by a gum dissolved in spirit of wine, and precipitated with water; which would be filled with small globular atoms, and look white.

Dr. GREW remarked, that himself had assigned the same cause of the whiteness of vegetable milks in his discourse on the *anatomy of trunks*.

Mr. LEEWENHOECK's letter added, that the globules of phlegm were the same with those of the blood, but tougher and greener, &c.

Part of this letter not being yet translated was referred to the next meeting.

The president presented the Society with a curious horn, commonly called an unicorn's horn, being very intire and in length almost eight feet, wreathed and tapered to a sharp point. It was at the greater end hollow like an elephant's tooth for about seven inches in length. The biggest part of it was about one foot from the hollow end, where it was eight inches about. It had eight wreaths in the length, and was not perfectly strait, but a very little bent, which might be perceived, if it were looked upon end-way. Its substance was pretty white, and of about the same hardness with ivory.

Sir JOHN HOSKYNS mentioned, that there was lately printed a book concerning these kinds of horns; as also it was remarked, that OLAUS WORMIUS, in his *Museum*, had given a description of one, and of the fish, out of whose snout it grows.

Dr. CROUNE mentioned a relation of Dr. HAMEY, that * * [i]

Mr. HOOKE mentioned the relation, which he had received from Mr. NEWLAND, of the like accident, which happened to a ship, wherein he was concerned, in its voyage from the Streight's mouth to Alicant, from a sword-fish, of which the Society had received an account formerly.

Mr. HOOKE produced his experiment, in order to explain the pressure of the air upon the mercury in the barometer; which was a large tube of glass about three feet long sealed at one end, and opened at the other. This was filled with water pretty near the top: then a glass made of the form of an inverted syphon,

[h] Mr. HOOKE's Lectures and Collections, part 2, book, vol. vi. p. 41.

[i] This minute is imperfect in the Journal-

and containing at the bottom a pretty quantity of mercury. This tube being gradually funk down into the water, it was very obvious, how the preffure of the water upon the mercury in that part of the fyphon, which was open to the water, depreffed it, and raifed the fame in the other part, which was opén to the air, and excluded the water. And it was plainly fhewn, that the cylinder of mercury kept up by the preffure of the water was always about a fourteenth part of the length of the water-cylinder between the furface of the quickfilver and the top of the water. It was farther explained by him, and fhewed, that the air and water in this reprefented in all circumftances material in this trial the æther and air in the common barometer; that the mercury was common in both: for, as it was fuppofed, that the barometer at the top of the cane admitted the æther and excluded the air, fo in this it admitted the air and excluded the water.

He farther fhewed how the alteration of the fpecific gravity of the air alters the preffure, though the cylinder or altitude of the preffing atmofphere were the fame: to make which more plain by an experiment, the frefh water, with which the great glafs was filled, was poured out, and was filled with a very ftrong folution of falt, care being firft taken to obferve the exact comparative hight of the mercurial cylinder to the frefh water cylinder: and it now appeared very plain, that the fame altitude of falt-water kept up a cylinder of mercury much higher than the frefh water.

Here by the way Mr. Hooke fhewed how the preffure of the air decreafed, as by afcending a mountain approach is made nearer to the top of the air. And he mentioned, that he had formerly brought in to the Society divers difcourfes and experiments; by which he had fhewn, that the preffure of the air actually decreafes in gravity, according as the experiment was made farther from the centre of the earth, after the fame manner as the decreafe of the preffure of the water was very vifible in this inftrument. He added, that he was preparing an inftrument for fome trials to that purpofe, which he would fhortly fhew. Thefe were two other inftruments of the like nature with thofe other, which he had produced fince the laft recefs of the Society: which inftruments were not defigned to fhew one or two fingle experiments and no more, but to be conftant and ftanding inftruments, whereby all the phænomena of gravitation and preffure may be explained by hundreds of experiments.

Farther, when a query was made, why the longer end of the fyphon was not fealed up, but remained open; which was otherwife in the barometer, Mr. Hooke explained the fame, and fhewed, that it was by reafon, that the fpring of the air, that was included, would vary its preffure upon the rifing or falling of the cylinder of mercury, which being left open, the weight of the air did not any more than the other did in the barometer.

Upon this fome queries being made concerning the fpring of the air, Mr. Hooke explained that theory, and fhewed, that, as the preffure of the water in the greater cylinder increafed, it raifed the mercury in the oppofite leg; and as that

that rose, so the air thus included would be condensed into a less room, and consequently have so much the stronger spring.

Dr. WHISTLER objected, that though the air was more condensed, yet he conceived, that the spring of it did not increase proportionably; explaining his supposition by the instance of a fleece of wool, which would only spring so much, and no more.

To which Mr. HOOKE answered, that though that might seem a little to explain what is meant by the springiness of the air, yet it was no way fit to make out all the appearances of the springiness of it: for that, as he had also formerly proved in the Society, the spring of the air is always condensible and rarifiable, which the wood is not: and that the force of the very spring is always proportionate to the condension of its bulk.

The president hereupon desired, that such an experiment might again be shewn at the next meeting, which Mr. HOOKE promised to take care of and contrive accordingly. He promised likewise, at the president's desire, to shew hereafter his theory of springs in general, having several years before shewed it to the king.

Upon this several queries were made, whether the air near the earth were not of very different degrees of specific gravitation; and whether the pressure was the same. To which Mr. HOOKE answered, that the parts of the air, as to their expansion, vary very much, according to divers circumstances attending them, viz. pressure, heat, &c. That oftentimes the parts of the air near the earth might be much lighter *in specie* than those at a considerable hight above it: that though in the experiments of rarefaction of the air, it were shewed, that the higher parts must always gradually grow lighter and more rarified, yet in the atmosphere it did not always happen so, but that sometime the rarefaction and condensation went *per saltus*, and by very great leaps. As an argument of this he urged the swimming of the clouds in the air; which seem to be upon the smooth surface of some fluid underneath them, all the under sides of them being perfectly defined, smooth, and horizontal; whereas all the upper sides of them are undefined and in heaps. Hereupon Mr. HOOKE said, that he had an instrument for examining the specific gravity of the air, which was distinct from spring or pressure.

Dr. HOLDER mentioned, that somewhat like this was also to be observed in smoke, which will run along, and spread itself a great way, keeping as it were the same distance from the ground.

Dr. KING instanced, that a gentleman, who was a patient of his, could two or three miles off from London discover when he entered into the smoke of London.

Upon this some discourse arose about the reason, why some chimnies smoke,

that is, do not convey the ſmoke from the fire up the funnel, but ſuffer it to ſpread into the room.

Dr. WHILTLER remarked, that there were four ways uſed for curing chimnies, according to their different cauſes of ſmoking:

1. By pipes added to the top, where the funnels being too ſhort was the cauſe.

2. By a ſmall pipe in the chimney, if the room be too little to ſupply a conſtant current of air.

3. By a cover turning like a weathercock, where a free exit of the ſmoke is deſired.

4. By leſſening the chimney, and making a chimney within a chimney, when the latter is too big.

Mr. HOOKE gave a reaſon, why in this experiment the mercury would of itſelf riſe higher in a greater, and lower in a leſs pipe: and why water would do the quite contrary; which by the experiment then ſhewn was plainly made appear to be ſo. He ſhewed, that this was the ſame with what he had long before publiſhed.

He added, that theſe and all other experiments, that had been formerly made by the Society for the examination of the nature and properties of the air, though they had been hitherto the opprobrium of the Society from ſuch perſons, as thought themſelves maſters of all knowledge *a priori* and by revelation; and deſpiſed all ſuch, as was acquired by experimental inquiry; yet there is no ſubject in nature more proper for the Society's examination and exerciſe. For whatever may be ſaid, that the weighing of the air, and the exhauſting and condenſing it in æther-veſſels, and the like, are trivial and impertinent tricks; yet he doubted not to make it evident, that an exact and thorough knowledge of that is of more concern to mankind than all the other phyſical knowledge in the world. For it is by that we continually ſubſiſt, and without it we cannot live one tenth part of an hour. It is from that proceed the cauſes of infinite diſeaſes; and it affords as many remedies for thoſe diſtempers. It is that, in which we continually reſide: it is the cauſe *ſine qua non* of all vegetables and animals upon the land; and influences even the fiſh in the ſea. Infinite and unſpeakable are the uſes of it to the huſbandman, the merchant, the tradeſman, the mechanic, &c. And that age will be deſervedly famous, which ſhall perfect the theory of it.

January 24. The preſident and vice preſident being abſent, Mr. EVELYN at the earneſt deſire of the members preſent took the chair.

The minutes of the laſt meeting were read, and ſome amendments were made about

about the relation [k] concerning the worms in the cavities of the *os frontis:* upon which occasion Dr. CROUNE added, that he had obferved, that the cavities of the *os frontis* and the little cells of the nofe having in them a kind of gelly or flime, are often filled with worms in fheep and other cattle; and that he had obferved the fame thing in a human fkull: but he conceived, that thefe little worms were engendered in the man's head, which he had anatomized after the death of the perfon, he having found them feven or eight days after that perfon's death. He was of opinion alfo, that the tickling of thefe kinds of worms under the horns of ftags, the faid cavities extending under them, was the caufe of the ftags rubbing their horns. He cited QUELFER for the firft author of this obfervation.

Dr. WALTER NEEDHAM added, that the gelly, which countrymen take out of the heads of cattle troubled with the ftaggers, &c. was cut out of thofe cavities.

Upon the mention of Dr. PLOT's way of preventing fmutty corn, it was fuggefted, that it was in the fkill of choofing the feed before fowing, and in nothing elfe.

Upon the difcourfe, that was about the inftrument propofed at the laft meeting for examining the different preffure of the air at different hights above the furface of the earth, Mr. HILL fuggefted, that it was very defirable, that a lift of inquiries and experiments might be made for that purpofe.

Dr. CROUNE mentioned, that Monf. PASCAL at Paris had upon making this experiment found, that there was five inches difference in the altitude of the mercurial cylinders in the barometer at the top and bottom of the mountain, on which it was tried; and that one inch of altitude in the mercurial cylinder anfwered to about a thoufand feet of altitude in the atmofphere or air.

Mr. HOOKE remarked, that this proportion of the two cylinders of mercury and air was not at all times alike, by reafon that the fpecific gravity of the air alters from many caufes; as does alfo the fpecific gravity of the mercury: but that by this inftrument, which he was preparing, that inequality would be difcovered.

Mr. HOOKE produced two experiments, which he had promifed at the laft meeting, being thofe which were mentioned in the firft part of Mr. LEEWENHOECK's letter; viz. concerning the conftituent parts of blood and milk; which were very plainly to be feen by making ufe of a fmall piece of looking-glafs plate (inftead of the ufual foot of the microfcope) which was very fmooth and clear; and by fpreading a little of the blood and milk on the top of it, and looking againft the flame of a candle. From whence it appeared, that the blood confifts of two fubftances, the one a containing liquor undetermined and undiftinguifhable as to its

[k] In the minute, which is left imperfect in the Journal book.

parts, flowing about and incompaffing the other, which confifts of an infinite number of exceedingly fmall parts, which were plainly perceived to be globular: all which parts were very equal as to bignefs, and were feen upon the turning of the microfcope to move to and fro very fwiftly and very freely, they feeming to crofs one another very much, and to move confufedly, though all tending the fame way.

In milk the like fubftances were very vifible, only with this difference, that whereas the globular parts of the blood were all of very equal magnitudes, thofe of milk were extremely different. Thefe were exceedingly white like little pearls, whereas thofe of the blood were red.

The latter part of Mr. Leewenhoeck's letter was then read, wherein he gave an account of his obfervations fhewn on flegm, in which he had difcovered the fame globules, as in the blood; but that the veficles, as he conceived, of them had received fome kind of corruption and greennefs.

He added alfo his obfervations of fome exceedingly fmall animals in pepper-water not one thoufandth part fo thick as an hair, but three or four times as long as thick. Thefe fhot very nimbly through the water, and the length of their fhoot was about half a hair's breadth. In old pepper-water likewife he had found eels no thicker than the former, and but one hundredth part of the length of an eel in vinegar.

January 31: Mr. Henshaw, vice-prefident, in the chair.

Upon reading the minutes of the laft meeting the vice-prefident related, that the fmuttinefs of wheat proceeded from a certain mildew or honey-dew falling upon the ftanding corn in the night; which, when the fun rifes, is dried and fixed upon the wheat, and hinders the growth; whereby the corn becomes withered and corrupted: and that this is the reafon is probable from the method of fecuring corn from fmut, by two mens taking a rope between them, and walking along the furrows on each fide the corn, and carrying the rope ftiff and ftrained, fo as to brufh off the mildew from the ears and blades of the corn. An account of this was given by Sir James Long, as likewife by Sir Hugh Platt in his book.

Some of the members were of opinion, that mildew is an exudation from a plant, and not a moifture precipitated out of the air, by reafon that it was found more upon fome plants than upon others; and that it feemed to participate fomewhat of the nature of the plant: that mildew and honey-dew are the fame: that the true name is meldew or honey-dew: and that it falls or is found fticking much upon the afh.

Sir John Laurence mentioned, that he had obferved, that the trees about Tunbridge afforded fuch a kind of fweet dew; and that if it drops upon any thing, it was of fuch a nature, as that it left a ftain behind not to be gotten out.

Dr. MAPLETOFT conceived, that manna is nothing else but such a dew gathered from the leaves of the fraxinus and ornus chiefly; and he affirmed, that JOHANNES NARDIUS was of the same opinion in his book[l]; as also Mr. RAY and JOHN BAUHIN.

Dr. MAPLETOFT remarked, that Dr. THOMAS CORNELIUS in Mr. RAY's catalogue[m] gives an account of the way of gathering manna.

Mr HENSHAW mentioned, that the extract made by the bees from plants and flowers was nothing but this *mel* or honey-dew, which he conceived to be partly a dew and partly an exudation: that the bee with its long tongue licks up this substance, and fills with it a place within its body: but that what is more properly the gum of the plant, is the wax, which the bee disposes upon its thighs on the outside.

Mr. HOOKE then exhibited the experiments of the last meeting, to shew the great fluidity of one part of the blood and milk above the other; whereby it plainly appeared by the very free, swift, and confused motion of those exceedingly small globules through the body of the liquor, in which they swim, that it must be very fluid and yielding.

Mr. HOOKE produced and read a letter sent to him from Mr. JAMES YOUNG of Plymouth, containing an account of an accident, which happened to one Mr. ANTHONY WILLIAMSON of L** in Cornwall upon swallowing bullets, one of which slipped aside, and went down his wind-pipe, and produced very sad and fatal symptoms, which ended with his life. This letter mentioned what Mr. YOUNG had observed in the body upon opening it after death; and that he had found the bullet in the left branch of the trachea, where it lay without being altered in its figure, or having made any impression on the trachea, though the lungs were corrupted beyond it.

Sir CHRISTOPHER WREN mentioned, that a relation of the lord WENMAN, upon swallowing a bullet down into his lungs, had been freed from the same not long after by a person, who turned him with his heels upwards, and shook him, and thereby making him cough occasioned the bullet to fall back into his epiglottis, and from thence by the cough to be thrown out with great violence, and so he had no farther mischief thereby.

Mr. HILL related, that * *[n]

Dr.   related, that Dr. MILLINGTON had tried the same.

Dr. ALLEN added * *[o]

[l] *Disquisitio physica de rore*, printed at Florence in 1642.

[m] Catalogus Plantarum Angliæ, p. 118. edit. Londini, 1670.

[n] This minute is left thus imperfect in the Journal-book, vol. vi. p. 48.

[o] This minute is left likewise imperfect.

Mr.

Mr. Coldwall presented for the repository two glasses, one containing a large locust, a cricket, a very large spider, &c. the other containing a flying fish, two or three very small fishes, and some other small fishes.

A letter was read directed to the Society from Mr. Edward Smith dated from his house without the south gate of Chichester, 22 January, 167⅞, containing a discourse about the explication of the table of Hermes, and the grounds of his philosophy. It being late, the discourse itself could not be read; but Mr. Oliver Hill was desired to peruse it, and to communicate his thoughts concerning it at the next meeting; which he promised to do.

Mr. Chetwynd, Dr. Dickenson, and Mr. Lane were elected.

Mr. Hooke produced a book of *Jean Jordan*, intitled *Deux Machines jusques ici inconnues*, *&c.* printed at Leyden in 1677, sent by one Magnus Hesentsalerus, directed to Mr. Oldenburg. This book having been perused by Mr. Hooke, was found not to contain any description of the instruments, but to relate only what the machines would perform, which was thought impracticable, if not impossible.

Mr. Hooke produced likewise a book published by Mattheus Campani, intitled *Horologium solo Naturæ Motu Temporis momenta metiens*, *&* *Circinus sphæricus Lentibus poliendis*, *&c.* of which he gave the following account: that this writer, who was rector of a parochial church, and seemed from some passages in his book to be brother to that Campani, who made glasses in Rome, endeavoured to make himself the author of two inventions, which had been long before published and shewn to the Society by one of their own members. The first, of two pendulums rectifying one another was shewn by Mr. Hooke, 2 January, 166$\frac{6}{7}$ [p], as appeared from the Journal, and from the testimony of many, who could not have forgotten it. The second, called by Campani *circinus sphæricus*, for making of glasses, was the same with that published by Mr. Hooke in his *Micrographia*, in 1664; who did not doubt but that this pretended inventor was aware of it, since otherwise he would not have endeavoured to antedate it so much as he had by making it prior to the 6th of October, 1664, citing a letter of Monf. Huygens for his voucher, though the words quoted by him assert no such thing. But upon a perusal of the book it was plain, that Campani could be the author of neither of the inventions, since he seemed not to understand either mathematics or mechanics enough to know, whether the things were true, when done; and therefore it was very improbable, that he was the inventor of either. Nor did he at all explain how either of the inventions may be performed either mathematically or mechanically, as any one upon perusal would easily find.

February 7. Mr. Henshaw, vice-president, in the chair.

Upon reading of the minutes of the last meeting concerning mildews, Mr.

[p] See above, vol. ii. p. 137.

Henshaw

HENSHAW related, that his gardiner had ſhewed him a ſubſtance, which fell upon his hat from the clear ſky in an evening in the month of December: that upon examining it, he had found it taſteleſs and of a ſubſtance like the white of an egg: and that therefore it ſeemed probable, that many of thoſe dews and glutinous ſubſtances, which were taken upon the leaves of plants, were dropt upon them out of the air. Others were of opinion, that they might proceed from the exudation, tranſpiration, or ſweating of the plant. To this purpoſe Mr. HOOKE mentioned the great tranſpiration, that is obſervable in all plants, and particularly in ſuch, as have been nouriſhed by water kept in glaſſes: for whoever ſhall examine the conſumption of the water, in which a plant is nouriſhed, and compare it with the ſame quantity of water kept in a glaſs by it, and ſhall alſo compare the weight of the plant to obſerve its increaſe, will find, that a very great quantity of the ſame is eaten up as it were by the plant; and the greateſt part of that is again caſt out by tranſpiration. And poſſibly from ſome unnatural or unſeaſonable blaſt of wind, the natural tranſpiration being ſtopt, that water might thicken into a kind of ſweat, which ſticking on the ſurface produced the mildew.

Upon the mention of the microſcopical experiments Dr. KING related, that he had with his microſcope examined ſeveral ſubſtances, to ſee, whether he could diſcover thoſe differences of parts, which had been found in blood and milk: but he affirmed, that he could not obſerve any ſuch in clarets or red wines or in any other wines. But that he had obſerved in an infuſion of wheaten bran in common water, and alſo in an infuſion of ginger, a great multitude of thoſe exceedingly ſmall animals; and in this latter a particular ſort of very ſmall eels moving much like thoſe of vinegar.

He remarked likewiſe, that he had examined the ſerum of blood and rain-water, but could not diſcover any animals in either of them.

It was deſired, that it ſhould be tried, whether white pepper ſteeped in water would produce any ſuch ſmall creatures.

Mr. HOOKE mentioned, that he had found great quantities of thoſe worms in rain-water; and that he ſuppoſed them to be generated therein from ſmall inviſible creatures flying up and down in the air, after the ſame manner as other ſorts of inſects in the ſummer-time had been obſerved by Mr. HENSHAW to be bred in rain-water from gnats, and to be converted into them again at laſt: that he had obſerved them alſo in river-water and well-water, though not ſo plentifully: that though the pepper-water, in which theſe animals were ſwimming, were frozen into a lump of ice; yet letting it alone to thaw of itſelf he had found it again very full of thoſe living worms, as if the froſt had not done them any harm at all: that he had found alſo a ſort of flat animals, which would contract and dilate their bodies ſomewhat like a leech; and that their motion in the water was different from that of any other creatures, which he had ever ſeen in the water, viz. a motion of writhing their bodies in the ſame manner as a board does, when it is ſaid

ſaid to be out of winding; and that thereby they guide themſelves, and ſhoot through the water with great ſwiftneſs.

Dr. MAYOW [q] was propoſed candidate by Mr. HOOKE.

Mr. HOOKE ſhewed an experiment to prove the ſtrength of the expanſion of the air to be in proportion to the quantity of the air contained in the ſame ſpace; ſo that half the quantity had half the ſtrength, and double the quantity double the ſtrength. This was ſhewed by a glaſs-cane ſunk down into another filled almoſt to the top with quickſilver. The firſt was open at both ends, but the other hermetically ſealed at the bottom. In the firſt was left about three inches of its length filled with air, and the top of it was ſtopped with ſoft wax, that no air might enter in or go out through. Then this cane was lifted up ſo far, as till the air was expanded into twice its dimenſions, and the quickſilver under it was obſerved to riſe only to half the hight of the ſtandard. When by lifting it higher, it had acquired four times its firſt dimenſions, the cylinder under it was found to riſe but three fourths of the ſtandard; which plainly evidenced one part of the former theory, viz. that the force of the ſpring of the air was diminiſhed in proportion to the expanſion; and that half the quantity had but half the ſtrength.

The other part of it was deſigned to be exhibited by another apparatus, which was made ready for this trial; but upon examination it was found, that a little part of the top of the glaſs for that trial was flown off; and therefore the experiment was deferred till the next meeting.

Upon diſcourſing of the hight of the mercurial ſtandard, Sir CHRISTOPHER WREN propounded, that the meaſure thereof might be reduced to the univerſal ſtandard, viz. the length of a pendulum moving a ſecond of time, which was between thirty-nine and forty inches long; and which was the ſame all over the world, and would ever be ſo in all ages.

Mr. OLIVER HILL being called upon for his report of the diſcourſe of Mr. SMITH of Chicheſter, which had been delivered to him at the laſt meeting to be peruſed, returned this account, which remained annexed to that diſcourſe,

Dignus, digniſſimus, qui nunquam imprimatur; ſed Monſieur Harpocrati aſſervandus mandetur, ne ullius manibus conteratur libellus.

February 14. Sir JONAS MOORE, vice-preſident, in the chair.

The minutes of the laſt meeting were read, and ſome parts diſcourſed of: after which

An experiment to prove the force of the compreſſed air was ſhewn by Mr. HOOKE,

[q] Probably JOHN MAYOW, M. D.

Hooke, by which it evidently appeared, that the force neceſſary to condenſe the air was always proportionate to the condenſation. Which was verified by ſeveral trials of ſeveral degrees of condenſation; that is, to condenſe the air twice, required twice the ſtrength, and thrice, three times the ſtrength, &c. that is, if the ſame quantity be condenſed, then the force or weight of the power, that makes the condenſation, ſhall always be reciprocal to the dimenſion: but if the dimenſion be the ſame, then the force ſhall be always proportional to the quantity of air contained in that ſpace. This was experimented in a tube of glaſs about ten feet long; the one end of which was ſealed up hermetically, and turned or bent back again in the form of a ſyphon reverſed; in which reverſed part there being left ten inches of air, quickſilver was poured into the other part, till the weight thereof had condenſed the ſame into five inches ſpace; the hight of which cylinder of quickſilver was found to be about thirty inches. Then the pouring in of quickſilver was continued till the ſame air was condenſed into two inches and a half, and the hight of the cylindrical mercury was found to be ninety inches. And the ſame proportions were obſerved to be in other compreſſions.

Sir Jonas Moore preſented the foot of a ſea-fowl for the repoſitory.

He gave likewiſe a large hornet's neſt brought from the Weſt Indies, which was ſeveral large combs faſtened upon the twig of a bough and very thick covered with a ſort of leaves or rather cloth of the make of the hornets: which being looked upon with glaſſes was found to be made up of abundance of ſmall threads, and appeared much like the texture of paper. With theſe the whole ſtructure of combs was cloſely inwrapped on every ſide, as if deſigned to ſhelter and incloſe the neſt of the young from the injuries of the air and weather, being a kind of natural hive.

The vice-preſident mentioned, that he had a letter from Mr. Halley from Saint Helena mentioning his obſervation of the laſt viſible conjunction of the ſun and Mercury.

February 21. Sir John Henshaw, vice-preſident, in the chair.

The minutes of the laſt meeting were read; and by the way, upon the mention of the hornet's neſt, Sir John Hoskyns remarked, that Mr. Wheeler had ſeen the way of bee-hives.

Mr. George Ent preſented to the Society for their library the new *Pharmacopœia Londinenſis*, reprinted and amended by the care of his father Sir George Ent.

Mr. Hooke produced an inſtrument to examine and ſhew at all times the ſpecific gravity of the air, in which it is placed, without any reſpect to the heat or cold, preſſure or ſpring of the air: but the ſaid property of the air was not ſhewed ſingly by any other inſtrument; nor was it proper or capable to ſhew any

 other

other quality of the air, as some had thought, except only the specific gravity of the air. This instrument was first proposed by Mr. HOOKE to the Society as appears from the Register-book: but the experiment and instrument itself was not before this time exhibited at the meetings of the Society.

This instrument made to demonstrate the said property of the air was a very large and thin ball of glass sealed up hermetically. It was suspended at the end of an exact beam (which would easily turn either one way or the other) and was counterpoised by a small weight of lead or brass; but lead was best for that purpose. Then Mr. HOOKE explained the same, and shewed the reason, why the ball would rise when the air, in which it hung, was heavier, and sink when it was lighter; and that it depended upon the same ground with the improvement of ARCHIMEDES's experiment by GHETALDUS.

He also explained the difference between the pressure and the specific gravity of the air. Whereupon Sir JOHN HOSKYNS added, that this was properly the barometer, and not the instrument so called.

Sir JOHN LOWTHER demanding, whether this instrument now produced was exact enough to make the small mutations in the air visible, Mr. HOOKE answered, that he did not exhibit this for any other use than to shew the ground and a reason of the thing, and as a sensible object, upon which to reason and discourse, and for the more plain demonstration and explanation of all material doubts, that might arise; because without such a pattern or model of the thing designed, the propounder of such experiment or invention is for the most part not so readily understood, and very often mistaken or misapprehended by the auditors: nor can objections be pertinently made where the like model is wanting, especially in all mechanical subjects.

Dr. WHISTLER objected, that this model itself was not satisfactory, but that experiment ought to be made with such an instrument, as both the ball and counterpoise might be immersed in the water; and when so immersed, salt might be added to make the specific gravity of the water greater: that then it might appear, which would sink, whether the ball, or the counterpoise, to which it was annexed.

Sir JOHN LOWTHER answered, that the matter was the same, and appeared as plain, whilst the bells hung in the air, as if they were suspended in water; for as the weight of any body suspended in water was always made so much lighter as the weight of a quantity of water equal to it in bulk weighed, and consequently the heavier the water, the more it would take off from the weight of the ball, the same thing must necessarily follow in air.

However, because in the experiment of weighing, that had been made, both the ball and the counterpose had not hung in the same medium, it was desired, that an experiment should be shewn to verify that assertion, which Mr. HOOKE promised to give order for against the next meeting.

Mr. HOOKE then shewed the *Journal des Sçavans* in which was contained the observation of Mercury in the sun made by Monf. GALLET at Avignon[r], the manner of which he in short explained to be very ingenious, proper, and accurate; and that seemed not to be defective in any material circumstance necessary to be taken notice of in the observation: that Monf. GALLET had remarked several immersions of Mercury, taking the declinations and right ascensions of it in every one of those places by a method very exact; and that thence he had deduced by trigonometrical calculation the longitude and latitude of Mercury in those several places, and the inclination of the orb and the true time of the conjunction: that he had taken notice, that the body of Mercury was oval, whose longest diameter was parallel to the equinoctial; and that at the emersion of it out of the eastern side of the sun it seemed to spread itself as it were upon the limb of that sun, appearing four times as big in diameter.

Mr. HOOKE acquainted the Society with the contents of a letter of Mr. HALLEY from Saint Helena directed to Sir JONAS MOORE giving an account of the same observation made by him in that island: but the letter was restored to Sir JONAS MOORE.

From either of these observations singly the theory of Mercury would be very much rectified, and from the comparing of them both together the parallax and distance both of the sun and Mercury would be experimentally verified.

Dr. ALLEN presented to the Society for their repository a natural bee-hive from Virginia fastened upon the twig of a tree, and very thick inwrapped round with such teguments, as are usual about a hornet's nest, which it very much resembled.

Mr. HOOKE promised, beside the experiment of weighing air, to have ready some microscopical observation.

February 28. Mr. HENSAW, vice-president, in the chair.

The minutes of the last meeting were read by Mr. HOOKE.

In prosecution of what was desired at the last meeting Mr. HOOKE shewed an experiment to elucidate farther the theory of the air-poise produced at the preceding meeting, viz. to prove, that a large and very light ball of glass ordered, as it was at the last meeting, would, upon change of the specific gravity of the fluid, in which it was suspended, rise and fall with such a motion, as would make such alterations visible. In order to which, because such alterations were difficult to make in the air, and because the last instrument was only designed to shew the gross mutations, and not the minuter ones, he having, as he affirmed, another way different from what was exhibited for producing that effect, which would be somewhat more chargeable to produce; therefore a glass sealed up as in the

[r] On the 7th of November, 1677, N. S. See Journal des Sçavans du Lundy, 20 December, 1677.

former experiment was ſuſpended at the end of a beam, and ſo ordered, that a counterpoiſe to it, when both under the water, was hung into a veſſel of fair water, which was taken notice of. Then into that water was put a ſmall quantity of ſalt, that ſo by the diſſolution thereof the water might be made heavier *in ſpecie*, and thereby the bigger body, which was the ſealed glaſs, ought to be made lighter than its counterpoiſe, every new fluid taking off ſo much more or leſs of the weight of the body contained in it, than was taken off by a former fluid, as a quantity of it equal in bulk to the ſaid contained body weighs heavier or lighter than the like quantity of fluid, in which it was laſt ſuſpended. Whereupon it was immediately very manifeſtly verified; for the glaſs-ball immediately upon the putting in of the ſalt grew very ſenſibly lighter, and the counterpoiſe preponderated; whereby all the objections and ſcruples, that were made concerning the former theory, were removed. And when inquiry was made, whether it could not be ordered ſo, as to make the minute variations more ſenſible, Mr. Hooke affirmed, that he had a way, by which he could make them as ſenſible, as ſhould be deſired; and that inſtead of varying an inch, he could make it vary ten, twelve, or more feet. The only inconvenience of which inſtrument was duſt, becauſe that ſettling upon the ſurface of the glaſs would augment the weight thereof: but for prevention of this, he ſaid, that a glaſs cover and caſe might be ſo ordered, as to prevent all thoſe inconveniences, and yet not at all hinder the air within from being ſenſible and compatible with the air without in the room, in which it was placed.

Mr. Hooke then produced an animadverſion of Signor Cassini upon the obſervation of Monſ. Gallet of the paſſage of Mercury under the ſun; wherein he compared that obſervation with thoſe of Gassendus in 1631, and that of Mr. Hevelius in 1671, from which he made ſeveral concluſions concerning the motion of the node and the inclination of the plane of Mercury to that of the ecliptic.

Upon this occaſion ſeveral reflections were made upon the obſervation of Monſ. Gallet of the oval figure of Mercury appearing in the ſun. Mr. Henshaw ſuppoſed, that it might proceed from the refraction of an atmoſphere about Mercury. Mr. Hooke conceived, that the body itſelf of Mercury might be of ſuch a figure; and that it might proceed from the velocity of its whirling round upon its axis, he ſuppoſing, that the axis of its vertiginous or diurnal motion lies north and ſouth, or at right angles with the ſeeming motion of it parallel to the   : that a very ſwift vertiginous motion on that axis made the body of Mercury ſomewhat of the ſhape of a turnep or of a ſolid made by an ellipſis turned round upon its ſhorter diameter; and he explained this hypotheſis of his by the ſhape, that a hollow globe of glaſs will readily run into, if the pantillion or pipe, at the end of which it is faſtened, be whirled round very ſwiftly. And the reaſon, which he conceived, why it muſt needs be turned round very ſwiftly, was on account of its nearneſs to the ſun, whereby the ſuperficial parts would be burnt, if it were not for the ſwiftneſs of its motion.

Here by the bye Mr. Hooke explained his way, which he had formerly delivered

livered to Mr. OLDENBURG, of making uſe of glaſſes of any length without a tube: which was as follows:

A rope was ſo ordered, as to join the two ends together, and ſo to make a round rope. This was put through the pulley both at the top and bottom, and a large ſquare or round board containing the object-glaſs, which was faſtened within a frame, ſo as to make it inclinable towards the eye, where-ever poſited; which was done by the means of certain ſtrings faſtened from the ends of the ſaid board, and extended from it to the cell of the eye-glaſs.

After this, upon a further diſcourſe concerning the appearance of Mercury in the ſun, there was much ſaid concerning the penumbra of ſhadows caſt by the body of the earth and by the atmoſphere thereof; and it was explained by experiments and reaſons, what part of the light of the moon in an eclipſe, eſpecially that of the darkened parts, was to be aſcribed to the penumbra or partial light from the ſun, and what to the light caſt on it by the refraction of the ſame in the atmoſphere: and it was ſhewn, that that undefinedneſs of light or ſhadow, which was obſervable in eclipſes of the moon, where part is ſhadowed, part inlightened, is to be aſcribed to the penumbra or partial light of the ſun: but that that light, which made the moon viſible in a central eclipſe, where no direct ray from the ſun can come at it, muſt be aſcribed to the refraction of the ſaid rays by the atmoſphere of the earth.

Mr. HOOKE promiſed to produce at the next meeting ſome microſcopical experiments, and particularly on ſome part of a muſcle.

March 7. Mr. HENSHAW, vice-preſident, in the chair.

The minutes of the laſt meeting being read by Mr. HOOKE, upon the mention of the air poiſe, and the experiment, in order to prove it, of weighing two bodies in water, it was very much doubted; though by the experiment of weighing in water the inſtrument became ſenſible, ſo as to turn by putting a little ſalt in the water: yet whether the very ſmall changes of gravity of the air could be made ſenſible by ſuch an inſtrument, was ſtill a queſtion. Mr. HOOKE affirmed it, and that in order thereunto he would provide a glaſs blown large and light on purpoſe, and ſo order it, as that its variations or differences ſhould be ten or twenty feet, if it were neceſſary; and conſequently that it would be capable of diſcovering the ſmalleſt alterations of the air.

He added, that he would ſhortly bring in a new inſtrument for the diſcovering of ſome properties of the atmoſphere not yet known or taken notice of, and hitherto altogether inſenſible to us, though by the ſaid inſtrument they would be made evident, and their natures diſcovered and determined.

Upon mentioning the particulars taken notice of by Monſ. GALLET, of the oval figure of Mercury, that ſubject was farther diſcourſed of, and Mr. HOOKE's hypotheſis was objected to, viz. that though ſuch an oval figure would be cauſed by the whirling round of a fluid body; yet it was probable, that the body of Mercury

Mercury is solid; and consequently this whirling could have no effect upon it. To which Mr. HOOKE answered, that though it might probably be now a solid body, yet that at the beginning it might have been fluid enough to receive that shape: and that though this supposition should not be granted, yet it was probable, that there might be about Mercury some fluid body, somewhat of the nature of the sea here upon the earth; and if this must be granted, it would be probable enough, that it would readily run into that shape, and make the same appearance: and that it is not improbable, but that the water here about the earth might do it in some measure, by the influence of the diurnal motion, which compounded with that of the moon he conceived to be the cause of the tides. But there were some other was of explaining those appearances, which, when he had time, he designed to draw up in writing.

Some objections having been made against the way of making use of long telescopes without tubes, Mr. HOOKE farther explained the way, and answered all those objections, and particularly that of Sir JONAS MOORE, who supposed it only theory, and that it had never been practised or made use of, Mr. HOOKE affirming, that he had done it, and found it convenient enough in a glass of twenty-eight feet; and therefore he conceived, that it might be as conveniently practised in a glass of any other length.

Mr. HILL desired, that the description of it might be fairly entered in the Register, that so such, as had occasion, might there receive instructions how to provide it, if they thought fit to use it.

The vice-president likewise moved, that the apparatus might be prepared, in order to shew the experiment of it at some meeting of the Society.

Upon a further discourse about the penumbra in eclipses, the vice-president said, that Mr. HEVELIUS had affirmed that penumbra to arise from the atmosphere, about the earth. But Mr. HOOKE asserted that to be a mistake, since the penumbra visible in eclipses of the moon proceeds from nothing else than the partial inlightning of such parts of the moon, as were in the penumbra by the light of the sun; for those parts, wihch are in the middle of the penumbra, are inlightened but by one half of the sun, the other half being shadowed by the body of the earth, which by an experiment with the candle, and an explication of schemes, was made so plain, that there were no farther objections made against it.

Dr. ALLEN presented to the Society for their repository a *Locusta Marina*, which had this remarkable circumstance, that the horns thereof were covered with a shell, so thickly set with very small and exceedingly sharp points, that it might readily defend and keep off all such creatures, as should come between them to offend it.

Mr. HENSHAW observed, that the cock-lobster, which Sir GEORGE ENT had shewed at Arundel-House, had a double instrument of generation, as the female had also a double receptacle.

He

He remarked likewise, that the bony substances in the stomach of the lobster, commonly called the lady of the lobster, were nothing else than the teeth, by which the food was chewed and pressed, doing the office of grinders, or *dentes molares*.

Dr. GREW added, that there were muscles and other bones, by which their motion was commanded and regulated.

Mr. GEORGE ENT presented to the Society for their library the Life of Mr. THOMAS HOBBES, composed by himself in Latin verse *, and written with his own hand.

Mr. HOOKE attempted to shew a microscopical experiment of the exceeding smallness of the parts of the tendon of a muscle, viz. that it was not above a twentieth part of the bigness of a hair in diameter; and consequently that a hair was four hundred times bigger than one of these. But upon making trial thereof, the tendon was grown so dry, that those minute parts could not be discovered, tho' the same were plainly visible in the morning. It was desired therefore, that the apparatus should be provided against the next meeting; and that the tendon should be provided fresh and fit for this experiment.

Mr. HOOKE then shewed several sorts of animals, produced in the steeping of annisseeds, coffee, &c. in water. These were much smaller than those of pepper, and had a quite contrary motion.

March 14. Mr. HENSHAW, vice-president, in the chair.

Upon reading the minutes of the last meeting, wherein it was supposed, that the oval figure of Mercury might be caused by the velocity of its turbinated or diurnal motion upon its own axis, Mr. HENSHAW objected, that if it were so, why did it not always appear of that oval figure, when it was seen at its greatest elongation, as well as when it was in conjunction with the sun? To which Sir JONAS MOORE added, that Mr. FLAMSTEAD was of opinion, that it was caused by the refraction or defect of the glass, and proceeded from mistake, and not from any real appearance, since he could easily make it appear so with any glass: and that there were many other mistakes in the said observation, which therefore could not be relied upon.

Mr. HOOKE answered to both these objections, that the figure of Mercury might really be always so oval, as Monf. GALLET had affirmed that he observed it; and yet through the inadvertency of others it might not be taken notice of, and that possibly for want of as good glasses as his, it might not have been visible before. To confirm which, Mr. HOOKE said, that Monf. GALLET had noted, that even in this observation through the three feet glass it appeared round. Secondly, that the reasons, why it may not appear oval in its greatest elongation, may be

* It was printed at London in 4to, about three weeks after Mr. HOBBES's death, which happened 4th December, 1679. It is reprinted at the end of *Vitæ* HOBBIANÆ *Auctarium*.

three,

three. 1. That it is very small and far distant, and very bright, all which circumstances make it very difficult, unless with very good glasses, to see any figure at all of its body, but only a radiating point. 2. That being seen only part inlightened, and never in opposition to the sun, the whole surface of it seen by us is never all inlightened, but only some parts of it; which is a sufficient reason to make it appear round, though the body of it be really oval, as is supposed; a part of this oval being really not seen, whereby the oval is changed into a circle. For it must be a very good glass, by which one is able to discover the true figure of Mercury, when half inlightened, by reason of its smallness and radiation; and it ought to be a very much better one to discover the figure of Mercury. 3. The figure of a dark body in a light medium is much better discovered than the figure of a light body in a dark medium, by reason of the radiation.

Next, as to Mr. Flamstead's supposition, Mr. Hooke said, that it was no ways probable, that a man, who had made the whole observations with so much care, and with so many witnesses, and besides had so ingeniously and knowingly contrived the apparatus for observing it, could either be deceived himself, or endeavour to deceive others; and therefore, till there were better arguments than conjectures or hypotheses produced against these circumstances of the observation, it ought not to be rejected or condemned.

Upon the mention of using long telescopes without tubes, several objections were made, as the bending of the lines, the difficulty of raising and fixing it, and the like. But Mr. Hooke affirmed, that he had actually done it: and that he had tried Mr. Hevelius's sixty feet glass without a tube, though it were afterwards tried also with a tube by Mr. Cock at Mr. Oldenburg's desire.

Hereupon it was desired, that a trial might be made of it with a pole of ten feet long, that thereby the Society might be satisfied of the practicableness thereof; which Mr. Hooke undertook to do.

Several discourses were made likewise about the penumbra, the result of which was, that it was concluded to arise from the partial inlightening of the parts in the penumbra, some parts of the luminous body being hid from them, whilst they were shined upon by other.

Mr. Hooke then read a discourse of Signor Cassini, concerning his farther prosecuting of the discovery of the diurnal motion of Jupiter upon its axis by the spot observable in one of the belts; wherein were several very remarkable circumstances and discoveries; that the same spot sometimes appeared for a certain space, and then disappeared again for a certain space: that the belts changed; and the two belts appeared like two rivers overflowing their banks, and running into one large one, with only some small spots or islands as it were between them: that the turbinated motion of Jupiter was sometimes swifter and sometimes slower, acccording as it more or less approached the sun: that he had stated the epoch thereof, and given the rule how to calculate for the future; that thereby the time of its coming to the middle of the disk might be observed to some few minutes

of time: that from the greater number of revolutions Signor CASSINI had divided the whole ſpace from the firſt to the laſt by the ſaid number, and found it to be ſometimes 9 hours, $55'$, $53''\frac{1}{2}$, ſometimes 9 hours, $55'$, $52''$, and $6'''$.

Dr. CROUNE produced a phoſphorus, the ſame with that of BALDUINUS, which he affirmed to have been made in England by an Engliſhman, altogether as good as that ſent hither by BALDUINUS himſelf.

Mr. HAAK affirmed, that he had another of the ſame kind; and that he had obſerved, that it appeared white, if it were expoſed to the light in the evening, when the ſun was almoſt ready to ſet.

Mr. HOOKE read a diſcourſe of his own, being an account of his obſervations, which in proſecution of Mr. LEEWENHOECK's diſcoveries he had made of the ſmall worms in pepper-water, and in the ſteeping of ſeveral other liquors, as of barley, wheat, oats, anniſeeds, coffee, &c. as alſo of ſugar, alum, blood, milk, fat, ligaments, muſcles, &c. and together herewith he diſcovered the ſeveral ways and contrivances by which he made thoſe obſervations; and therein ſhewed, how eaſily and apt ſuch perſons are to be deceived by the appearances of theſe tranſparent bodies through a microſcope, who are not aware of certain properties of tranſparent bodies, eſpecially ſuch as are peculiar to ſubſtances of ſuch ſmall bulk. And for the avoiding and preventing all theſe inconveniences, he ſhewed ſeveral ways and expedients, without which no true diſcovery could be made, and by the help of them they were very eaſily made. Some of thoſe mentioned by him were glaſs plates, and plates of Muſcovy-glaſs, particular kinds of light, the immerſing the bodies in waters and other liquors, the ſqueezing bodies between two glaſs-plates, the ſtretching and ſqueezing others with a kind of tongues, &c. whilſt they are looked upon in a convenient light by the eye. After which he ſhewed the method, by which he made two ſorts of microſcopes, and the conveniences and inconveniences of both theſe.

The firſt was a ſingle microſcope made by a ſmall globule of glaſs, by means of which, with very little or no difficulty, any object might be prodigiouſly magnified.

He alſo explained how the globule was made out of a thread of glaſs, and how that glaſs thread and ſmall glaſs-canes were made.

The ſecond was a double microſcope conſiſting of two glaſſes, whereby many obſervations might be more conveniently made than with the ſingle one. He then explained how, by the help of theſe, the parts of a muſcle, fibre, tendon, ligament, &c. might be examined: and to verify this by experiment, he produced a ſmall part of the ligament of the neck of a ſheep, and ſhewed it to conſiſt of an infinite number of exceedingly ſmall threads, four hundred of which would ſcarce make the bigneſs of one ſingle hair of a man's head. But as to the fibres of a muſcle, he affirmed them to be very different, which he would ſome other time produce.

 Dr.

Dr. CROUNE shewed a stone, on which a piece of alga was growing.

March 21. The president and vice-president being absent, Mr. DANIEL COLWALL was desired to take the chair.

After the minutes of the last meeting were read, a discourse arose about BALDUINUS's phosphorus; concerning which it was affirmed, that the same was then made in England as good as that, which was brought from beyond sea: and it was desired, that one of them might be procured to be examined at the Society at their next meeting: which Mr. HOOKE said he would endeavour to do.

Mr. HOOKE read a letter and relation, which he had received from the president, being both sent him from captain RICHARD ROLLAND from Tangier, 13th February, $167\frac{7}{8}$, containing an account of his trials made in the deeps of the sea; wherein he observed, that having, according to Mr. BOYLE's directions, lowered by the deep sidge line a bottle of oil of anniseeds, and two other bottles only filled with air, into eight fathom water, and there suffered them to stay a quarter of an hour, the oil was congealed, and the cork driven into the bottle; but the stopper had leaked through its pores, through which the same upon pulling up endeavoured to get back, making a noise and smoke.

The second experiment was with three bottles in an hundred fathoms water. The two bottles stopped with lignum vitæ were broken by the pressure of the water drawing them into the neck: the other stopped with cork was taken up whole, but the cork driven into the bottle, and the bottle filled with water; which being tasted, seemed somewhat fresher than the rest.

Upon this, a discourse arose about more exact ways of making these kinds of trials in the sea and other deep places. And Mr. HOOKE affirmed, that he had a way to examine the pressure to any depth with the greatest ease imaginable; and that was by a cane of glass, with which there had been several trials made near Sheernefs, of which there is an account in the Registers of the Society. That he had also other ways for examining the heat and cold of those submarine regions; and to fetch up the water from any depth; as also the earth, sand, &c. from the bottom: that he would give directions for the making of such an apparatus, if there were proper persons appointed to make trial with them.

Hereupon mention was made of great depths of waters within land, as of that of the lake of Geneva many hundred fathoms deep.

Dr. MAPLETOFT related, that cardinal D'ESTREES had caused the lake de Aqua by Padua to be sounded, but could find no bottom with a whole boat-full of line.

Mr. HILL mentioned, that the sea was so very deep at Messina, that the admiral of Spain could ride close to the key, and no bottom could be found by sounding-lines.

Mr. THOMAS SMITH related, that by Mr. JOHN GREAVES's experiment no bottom could be found at the Straits at a thousand fathom depth.

Mr. WHEELER affirmed, that there was a pool or lake in Wales, of which no bottom could be found.

Mr. HILL supposed, with good reason, that in trials of this kind, the lightness and buoyantness of the rope might at length keep the weight from sinking any farther; and so much more line might be taken into the sea than was necessary to measure the depth. It was thought also, that the motion of the under-parts of the water might bend the line very much.

Upon this mention mas made of the bending of the line of a pendulum hung from the top of St. Paul's before the fire; as also of some other experiments about trying the particular gravitation of bodies near to and at a distance from the surface of the earth; of which there are several accounts in the Society's Registers.

Dr. CROUNE moved, that there might be made an universal index to the Registers.

Mr. HOOKE shewed in the microscopes the manner how tallow coagulates, in order to explain the expansion of water upon freezing: and

The manner of the shooting of sugar dissolved in water upon the glass plate of the microscope.

1678. *March* 28. Sir CHRISTOPHER WREN, vice-president, in the chair.

Upon reading the minutes of the last meeting, a discourse was occasioned concerning the ways then spoken of for sounding the depth of the sea by the help of a long pipe of glass, the lower end of which was perfectly sealed up hermetically, and the upper end so ordered, as upon its descending to admit of the water to enter in, according as the pressure of the water was greater and stronger upon the inclosed air; and upon pulling up again of the same pipe, and so as the pressure of the water decreasing, the air expanded itself, and found its way out without forcing out again the water, which had been admitted in its descent.

Sir CHRISTOPHER WREN objected to this, that the compression of the air might be occasioned by the cold as well as the pressure of the water; and so it could not be distinguished which part of the admitted air was to be ascribed to the cold, and which to the pressure.

Mr. HOOKE answered to this, that it was necessary, that there should be other instruments let down with the said pipe, in order to find the degree of coldness in the water at several depths below the surface; and that the said experiment was not less instructive than the other: for the performing of which he alledged

that he had a contrivance, by which the ſame might be certainly examined, and thence the degrees both of the one and the other might be defined.

Some other objections were made, that the depth might be examined by the help of a line, as well as by the degree of preſſure. To which it was anſwered, that as for the meer finding the depth of the ſea, the line and plummet were not ſufficient, becauſe in great depths the line would be buoyant, and ſo not be ſtrained ſtrait: and where there was a motion of the water, the line would be often much ſloped, and ſometimes much bended. But beſides the examination of the depth, this tube ſerved alſo to inquire into the degree of preſſure at certain depths: which was another uſeful inquiry, and likewiſe helpful for the finding the qualities of thoſe lower regions as to heat and cold; which was a third inquiry worthy to be examined.

Sir CHRISTOPHER WREN ſeconded Dr. CROUNE's deſire of having an univerſal index made to the Regiſter-books.

He alledged, that he had not heard any real objection againſt the wooden balls for ſounding the depths of the ſea. To which it was anſwered, that theſe balls being ordered, as was directed in the *Philoſophical Tranſactions*, would certainly perform the effect, if care were taken to obſerve exactly when the balls appeared again above water; which was eaſy to be taken notice of in ſmall depths, and where the water was without motion. But where the water or the ſhip were in motion, ſo that the ball did not aſcend again into the ſame place, where it deſcended, and where the depth was very great, there the obſerving of the moment, and the place where it appeared again after it had been ſunk to the bottom, was very difficult, and hardly practicable. But as to the way of ordering the ball and weight, which was preſented by RICCIOLUS, it was very fallacious, the ball frequently letting go the weight before it came to the bottom; and at other times being detained altogether at the bottom without ſeparating from the weight, as had been found by trial; of which an account was entered in the Regiſter-book.

Mr. HOOKE ſhewed an obſervation of the figure of the ſmall and imperceptible parts of a muſcle, which he had diſcovered by the help of a microſcope. The muſcle, which he had made choice of for examination, was that of a lobſter's claw, the fabric of which was ſuch, that all the motion muſt neceſſarily be made in the fibrous part thereof; ſince firſt the tendon is nothing elſe but a bone, and ſo not capable of ſhrinking or ſtretching; and ſecondly, the other end thereof is faſtened immediately to the inſide of the ſhell.

In this obſervation notice was taken, that the ſmall fibres ſought for, though as much magnified and inlightened as was neceſſary, did not appear till by the adding a ſmall drop of water the irregular refractions on the outſide of the fibre were removed; after which it was very plainly viſible, that the whole fibrous part of the muſcle examined conſiſted of an indefinite number of exceeding ſmall ſtrings extended ſtrait between the inſide of the ſhell and the tendinous bone in the middle; which

which were ſo ſmall, that five hundred of them would ſcarce exceed the bigneſs of an hair.

Each of theſe ſmall fibres or ſtrings was conceived to be ſeen of the ſhape and figure of a wreathed pillar, or a ſtick naturally grown wreathed by the twiſting of a ſtring of ivy. Others ſuppoſed it of other ſhapes. But the determination thereof was left till another time.

Mr. Moses Pitt, bookſeller, having made a propoſal to the Society of his deſign of printing an Atlas, or deſcription of the parts of the earth, ſea, and heavens, contained in about ſix hundred copperplates or maps, and about nine hundred printed ſheets; and deſiring the aſſiſtance and encouragement of the Society for the more exact performance, and the better carrying on of this work; it was referred to Sir Christopher Wren, Sir John Lowther, Mr. Hill, Mr. Haak, Mr. Hooke, Dr. Grew, and Mr. Collins to conſider farther of this propoſal, and to report their thoughts of it at the next meeting of the Society; and the time of this committee's meeting was appointed on the Tueſday following, at ſix o'clock in the evening.

April 4. The preſident in the chair.

The minutes of the laſt meeting being read, Mr. Henshaw, upon the mention of the ways of ſounding the depth of the ſea, aſſerted, that in cardinal Cusanus there was another way of ſounding it, different from thoſe which had been deſcribed by Mr. Hooke, both by the help of a pipe, and alſo by the deſcent of a ball ſunk by a weight; which weight leaving the ball when it came to the bottom, the ball aſcended with the ſame velocity upwards, with which the weight and ball together deſcended to the bottom.

Hereupon Mr. Hooke explained the peculiar contrivance of the application of the leaden weight to the ball, which he had invented and made uſe of, being the ſame, which was entered in the Society's Regiſter. As alſo he ſhewed the uncertainty and inconvenience of the other contrivance, he having experimentally found, that it would often fail of performing the deſired effect, either by leaving each other before they came to the bottom, or not ſeparating at all when they came thither.

The preſident, Mr. Henshaw, and Mr. Hill made ſeveral objections againſt the way of ſounding the depth of the ſea by the aforeſaid contrivance with a ball ſunk by a weight: the chief of which were founded upon the ſuppoſition of Galileo, that deſcending bodies accelerate their motion continually in a duplicate proportion to the time of their deſcent; and therefore it ſeemed hard to conceive, how the theory propounded by Mr. Hooke would hold true, viz. that the time of the deſcent and aſcent of the ball is always in the ſame proportion with the depth of the ſea, be it more or leſs, provided it were about two fathoms deep. The reaſon of which he alledged to be, that by paſſing about two fathoms in the water,

water, the ball both in aſcending and deſcending would arrive to its greateſt degree of velocity.

The preſident farther urged, that GALILEO, GASSENDUS, and MERSENNUS had all affirmed the ſame thing, that all deſcending bodies accelerate their motion in proportion to the ſquares of the times of their continued deſcent: and that they had, upon this ſuppoſition, been at the trouble to calculate the time, that a body would ſpend in deſcending to the center.

Mr. HOOKE anſwered, that thoſe calculations had been made upon a theory, and not upon experiment; for that experiment would evidence the contrary. And though in a vacuity of water, air, or any other groſs fluid, thoſe proportions would hold very near; yet in a medium, wherein there was a reſiſting fluid body, it would not hold in any wiſe, eſpecially in thoſe, which had a conſiderable proportion of ſpecific gravity to that of the deſcending body. Hence he ſaid appeared the reaſon, why a down-feather being let fall in the air would deſcend therein, if it were not diſturbed, by an equal degree of velocity. But on the contrary, if the ſaid feather were let fall in a medium, whence all the air was exhauſted, and nothing but a fluid æther left, he affirmed, that it would fall therein, as to ſenſe, with the ſame accelerated velocity, that a ſtone would do in the open air. This, he obſerved, he had formerly ſhewed to his majeſty at White-hall. But that upon admitting the air into the ſpace, through which the feather was to deſcend, it was plainly ſeen to deſcend with an equal degree of velocity the whole ſpace, which was all the way very ſlow. He added, that *in vacuo* the deſcent of all bodies was equally ſwift, increaſing continually its velocity by a duplicate proportion to the time of continuance; but that in all gravitating mediums ſomewhat of that proportion is impeded. Hence he affirmed, that in the experiments tried from the top of St. Paul's ſteeple it was very plainly viſible, that a leaden ball would deſcend faſter than one of the ſame bigneſs of wood, and that of wood faſter than one of cork; inſomuch that the heavieſt would in that deſcent get near thirty feet before the other to the bottom. He further added, that even of bullets of the ſame ſubſtance the bigger would manifeſtly outrun the leſs in their deſcent.

As alſo, that all mediums whatſoever had ſome reſiſtance to the motion of bodies through them, and that even thoſe, which had leaſt, had yet a very conſiderable oppoſition to a motion, that was proportionably accelerated. Hence it was, that birds were able to ſuſtain themſelves in the air; and that one might break the ſtrongeſt oar by ſwiftly ſtriking it again the water.

And farther, that in the thinneſt medium, though the acceleration were pretty near what was ſuppoſed by the aforeſaid authors; yet that it was in none mathematically true, but that there would be in all mediums a certain degree of velocity, which the ſame deſcending body would never exceed, though other deſcending bodies might, and ſome others would never arrive to: after which degree was attained, the progreſs of the body would always be made by equal ſpaces in equal times,

times, though ever ſo far continued, provided the gravitating powers remained the ſame.

Notice alſo was taken, that GALILEO had ſuppoſed, that the motion of a common pendulum was iſochrone; but that it was afterwards experimented by MERSENNUS, that this aſſertion would not hold; though the other problem of GALILEO of the iſochrone deſcent of a body upon the inclined plains within the circumference of a circle were mathematically and mechanically true:

That Monſ. HUYGENS was the firſt, that found out, that the motion of the weight of a pendulum in a cycloid would make all its excurſions iſochrone; but that he was not the firſt, who applied the pendulum to a clock for the regulating thereof.

Sir JOHN LOWTHER queried, who it was, that firſt found out, that the motion of the deſcent of heavy bodies was not the ſame with what GALILEO had aſſerted.

Dr. CROUNE ſuppoſed, that it was Monſ. MONCONYS; and that he had it from a Jeſuit in France. But Mr. HOOKE thought, that this was diſcovered long before; and did not remember the mention of it in the travels of Monſ. MONCONYS; but remarked, that the Jeſuit RICCIOLUS had mentioned it long before in his *Almageſt*.

Dr. CROUNE added, that DE CHALES in his *Curſus* had ſaid much concerning it both from his own experiments and thoſe of others.

Mr. HOOKE ſhewed an experiment of the compreſſion of the water in a glaſs-pipe, in order to the exhibiting the experiment of examining the depth of the ſea. And it was very viſible, that the effect anſwered to what was aſſerted concerning it, viz. that the compreſſion was proportionate to the depth of the glaſs below the ſurface.

April 18. Sir JONAS MOORE, vice-preſident, in the chair.

The minutes of the meeting of 4th April were read, which gave occaſion to diſcourſe concerning ſeveral ways of ſounding the depth of the ſea.

Sir JONAS MOORE related, that he had made many trials with the ball and weights of lead for the ſounding the depth of the ſea: and that he had found it exceedingly difficult to determine any thing by them, by reaſon that it was almoſt impoſſible to diſcover them certainly at their firſt appearing above water, though they would often leap into the air to a conſiderable hight; and that was becauſe they would often riſe two hundred fathoms from the place, where they were let down into the water. That of twelve, which he had tried at the Straits mouth, not one was found at its firſt appearance. He therefore conceived, that they would be of very little uſe in the ocean, though they might be of uſe in very deep lakes, ſuch as that of Geneva, &c.

Here-

Hereupon a farther difcourfe was occafioned concerning the motion of afcending light bodies; and whether bodies afcending from a greater depth would not move much fwifter towards the latter end, and poife higher than thofe, which came from a lefs depth. And it was alledged, that a ball of fuch a poife as thofe made ufe of for founding the depth of the fea, would in its afcending acquire a confiderable velocity. But that degree being acquired it would not be more accelerated, though it afcended ever fo much farther.

Dr. CROUNE moved, that a theory of this matter might be brought into the Society.

Sir JONAS MOORE alledged, that in fhooting granados he had found, that the greateft random was below forty-five degrees of inclination. And that fhooting at twenty degrees would fly much farther than fhooting at feventy: the reafon of which was the denfity and refiftance of the air to the body paffing through it, whereby that, which was fhot at feventy degrees, paffing through a greater quantity of air, received a greater impediment and hindrance from moving exactly in a parabolical line, than that which was fhot at twenty.

Sir JONAS MOORE farther obferved, that the different denfity of the air at one time more than at another would caufe a greater impediment and deviation of the bullet at that time more than at another: that the motion of the air or wind would often bend the bullet confiderably out of its directed way: that the hollownefs of the fhell would many times make it pafs in a curve and not in a ftrait line; for that he had feveral expanded canvaffes fet up all exactly in a ftrait line; and that upon fhooting directly in the line he had obferved, that a bullet had paffed through the firft and laft, and yet miffed all the intermediate ones by deflecting either to the right or left fide of them.

It was then moved, that fome experiments fhould be made at the column [t] on Fifh-ftreet hill, of the velocity of the defcent of heavy bodies, and what the refiftance of the air is to that motion.

Mr. HOOKE affirmed, that he had a defign to make feveral experiments concerning that and other matters at that place; of which he would give the Society an account; as he had formerly done of thofe made at St. Paul's before the fire of London. He took notice, that there were in RICCIOLUS's *Almageftum Novum* a great number of fuch experiments made at Bologna at the tower of the Afinels.

Dr. CROUNE alledged, that Monf. DE CHALES in his *Curfus* had given a theory of the refiftance of the air to bodies moved through it, together with a great number of experiments to that purpofe.

Sir JONAS MOORE related, that a hurricane blowing off the ball from the top of the fteeple at Durham, the ball had acquired fo great a velocity in its fall from

[t] The Monument.

fo

ſo great a hight, that it ſunk itſelf at leaſt four feet into the ground; which he ſuppoſed to have been occaſioned by its great bulk and the great hight of the place whence it fell.

Mr. Hooke moved, that for the examination of the deſcent of heavy bodies trial ſhould be made with granados ſhot directly upwards, as near as might be, at Blackheath; in which trials obſervation ſhould be made of the time of their aſcent and deſcent; which might be very eaſily done, this being very viſible at a diſtance.

Mr. Hill alledged, that in Ricciolus there is an account of an experiment of ſhooting a bullet perpendicularly upwards; and that it had always been found to fall to the weſtward of the place, whence it was ſhot.

He added, that by many experiments tried at Dover Caſtle it had been found, that no gun in that place would ſhoot above a mile and an half into the ſea: the reaſon of which was ſhewn to be the proportion between the velocity of the horizontal and perpendicular motions.

Mr. Hooke ſhewed the microſcopical figure of the fibres of a muſcle, and explained the reaſon of their motion by a wreathed helical gut and a ſtrait ſtring, whereby upon blowing up the gut, and filling it with wind, the ſtring became helical and ſhortened, being twiſted about the gut: but when the gut was ſuffered to empty itſelf of the air, the ſtring lengthened and became ſtrait, and the gut twiſted about it in a helical figure.

Mr. Hooke propoſed alſo an experiment for the next meeting, to ſhew how the motion of the muſcle might be explained, ſuppoſing the ſaid fibres to be (like a necklace of hollow glaſs-beads, which it repreſented) a ſtring of ſmall bladders joined together by the necks.

Monſ. Papin, who was admitted to be preſent, ſhewed an experiment of a wind-gun of his own making and contrivance.

April 25. Sir Christopher Wren, vice-preſident, in the chair.

The minutes of the laſt meeting being read gave occaſion to diſcourſe concerning the reſiſtance of the air to bodies moved through them; and particularly concerning the figure, in which a granado is moved; how near it approaches to a parabola; and in what it varies from it: that in the motion of leſſer bodies in leſſer ſpaces the figure is ſo near a true parabola, that it is not poſſible, by any inſtrument yet known, certainly to deſcribe one nearer to the truth.

Sir Christopher Wren alledged, that he had by many trials found, that he was able by binding and fixing faſt his barrel, to ſhoot three ſhots in five into the ſame holes.

Sir John Hoskyns mentioned, that Sir Jonas Moore had affirmed, that he had done much the same thing with a cross-bow fixed fast to a rest, and shooting an arrow.

It was alledged, that those guns carried truest and surest, which were exactly bored and polished within, and that had a bullet exactly fitted into it; or that was forced through it by the strength of the powder.

After this a discourse was occasioned concerning the motion and fabric of muscles. And Mr. Hooke shewed an experiment in order to the explanation thereof, which was a chain of small bladders fastened together, so as that by one pipe the whole series might be filled; which they would be successively, one after another, that, which was next the pipe, being first filled, and then the next successively. Now it was supposed, that the globules of the fibres of the muscles, which seemed like a necklace of pearl, might be some fabric, as this of bladders, in which might be included a certain portion of air or other very agile matter; which air being included in so exceedingly small and very thin skins, was very easily wrought on by heat and cold, and other agitating properties of the liquors, that pass between them; and thereby they might be presently filled by the said included air being rarified and emptied by the condensation of the same from the want of that heat continued: and so by the successive rarefaction and condensation of the same air included in the aforesaid chain of bladders the string thereof was made either shorter or longer, each of which was so much the more, by how the rarefaction or the condensation was the greater.

Upon this an occasion was taken, to discourse of the causes of the motion of the muscles; and how far the air taken in by the lungs might contribute towards muscular motion. And it was thought, that it was of great necessity for that very purpose.

Dr. King was of opinion, that the motion of the muscles proceeded from the liquor of the nerves, and alledged the exceeding minuteness of the divarications thereof; insomuch that with a microscope it was possible to trace them till they were much smaller than the hair of a man's head, and yet might be found to divaricate and to cleave into more and smaller ramifications. He remarked, that he had tried these small divarications into the very middle of the body of these muscular fibres. It was judged, that both might be necessary to produce that motion.

Mr. Henshaw objected, that the divers for spunges and corals at Samos could hold their breath three quarters of an hour. Upon this also he mentioned his design of dissecting an otter, in order to inquire into Mons. Des Cartes's assertions concerning the *foramen ovale*, by which the blood of otters was supposed to pass from one ventricle of the heart to the other, without passing through the lungs: and thence it was supposed, that there was less need of the motion of the lungs or breathing, since it was thought, that the great use of the motion of the lungs was for the making the blood pass through them.

But

But against this he alledged, that in his opinion the otter had no *foramen ovale*; which Sir CHRISTOPHER WREN positively asserted, having dissected and examined an otter for that purpose.

Dr. KING affirmed, that an otter could not continue under water without breathing above four minutes, and then must of necessity come up and breath. And so long almost any man in cold weather was able to abstain from breathing.

Sir CHRISTOPHER WREN related, that the seal, that was in St. James's Park, had muscles, by which it could * * up the nostrils, and so sink itself, and lie at the bottom of a pool made for him, for a great while together; and that it would eat its food at the bottom of the water.

Then the discourse of muscular motion was farther prosecuted: and it was supposed, that those chains of globules might be filled with other liquors as well as with air. But Mr. HOOKE alledged, that the spirit of wine and divers other spirituous liquors were pretty suddenly susceptible of the degrees of heat and cold; yet in comparison with the exceeding sensibility of the air they were very slow and dull: and in order to explain this he promised to produce at the next meeting a glass, which should experimentally verify it.

Sir JOHN HOSKYNS objected, that the motion of the muscle could not be from the swelling or shrinking of the air; for that Dr. GODDARD had, by an experiment made in a vessel of tin, in which a man's arm was included, proved, that the arm took up no more room in the water, when the muscles were intented and made use of to pull, than when they were suffered to lie still without straining. To which Mr. HOOKE answered, that that experiment was not at all sufficient to prove or disprove the swelling or shrinking of the muscle; for that there being always some muscles, which counterbalance the other, and that as much as the one swells, the other shrinks; and so the same space is always filled by the two antagonist muscles together.

Sir CHRISTOPHER WREN supposed, that the swelling and shrinking might proceed from a fermentative motion arising from the mixture of two heterogeneous fluids.

Some difficulties occurred in this hypothesis, how the motion of some muscles should continue so long after they were cut off from the body of the animal. Mention was made of the muscles of the skin in flaying a dead animal; of the parts of eels cut asunder; of frogs stirring after the heart, lungs, and entrails were taken out.

Mr. HOOKE affirmed, that he had observed the heart of a monk-fish to beat many hours after it was cut out of the body.

May 2. Mr. HENSHAW, vice-president, in the chair.

 The

The minutes of the laſt meeting being read, wherein mention was made of the parabolical figure deſcribed by a bullet, and inquiry being made concerning the figure proper to each inclination, it was ſhewn, that the figure deſcribed by a bullet ſhot with any inclination whatſoever is a parabola.

Upon occaſion of a diſcourſe about reſpiration, Dr. Croune mentioned an experiment made by Dr. Merret of keeping young puppies a long time without reſpiration, by ſuffering them to remain in their ſecundine after they were taken out of the dam. This obſervation was confirmed by Mr. Hooke from his own trial; and he added, that he had found the heart of one of them beat the next morning, which he had taken from the dam the night before.

Dr. Croune hinted, that a creature might be ſtifled before the *foramen ovale* could be cloſed.

The vice-preſident anſwered to this, that it was a queſtion, whether the *foramen ovale* might not be cloſed before the birth; becauſe it had been obſerved to be cloſed immediately after the birth; and therefore it was not probable, that it could be done ſo ſuddenly.

Dr. Croune ſuppoſed, that there were other uſes of the *foramen ovale* than had yet been aſcribed to it; for that he had obſerved, that the blood circulated throughout the lungs, as well after the exhauſting the air by the wind-pump out of them as before: ſo that he ſuppoſed alſo, that even before the child had breathed, there might be made a circulation of the blood even through the lungs of the fœtus.

Upon this occaſion much was diſcourſed about the fabric of the lungs, and how the air might be clean drawn out of them by the wind-pump, though it could not be expreſſed out of them by preſſing them without breaking the little bladders.

Mr. Hooke explained the reaſon, why this effect might be performed the one way and not the other: and that was, that the little bladders, out of which the lungs were compoſed, were joined to the branches of the aſpera arteria like leaves to the ſprig of a tree: that the holes, by which the aſpera arteria and each of theſe bladders communicated, opened and cloſed according as the bladders were more or leſs expanded: but that they became perfectly cloſed up, when the bladders were not bigger than ſuch a determinate magnitude.

Mention was made of divers, who refreſhed themſelves by the help of ſpunges dipped in oil. This was taken notice of upon Mr. Hill's mentioning, that Mersennus had related, that a diver could hold his breath, and continue under water for an hour and a half without coming up to fetch breath: but that he had retracted this relation in another book, and acknowledged himſelf to have been miſinformed.

Mr. Henshaw added, that the ſeal in St. James's Park uſually received its food at

at the top of the water and upon the land, and then dived to the bottom and eat it there.

It was discoursed, that the specifical use of the air or respiration was difficult to guess it; for some experiments had proved, that there might be a circulation without the motion of the lungs; and that a man might be stifled, though he moved his lungs and breathed, if it were not fresh air. This was thought a good argument to prove what Mr. Hooke had asserted, that air was the pabulum of the animal spirits, and that, which was the principal cause both of the heat and animal motion; for that the blood was in the lungs both impregnated with fresh air, and so received an inlivening florid arterial colour, and also discharged great quantity of steams and fuliginous matter, that was contained in it.

This gave occasion to discourse of the reason, why several creatures leave a scent behind them, where they pass; so that dogs are able to follow them thereby a good while after they had passed along.

Mr. Hill observed, that in hunting a deer, the dogs would not always take the scent from the ground, but sometimes also from the boughs of trees, or any other thing, whereon the breath of the deer might settle.

Upon this discourse it was farther observed, that there were continual steams issuing from animal bodies, not only by the lungs, which vented the greatest quantity, but even from all the other parts of the body. And it was remarked, that if a man in cold weather stands with his shoes upon a marble stone, he would presently leave an impression behind him upon the stones, though his shoe-soles were perfectly dry, as was presently experimented. It was judged, that by some such steams as these left on the ground, upon which a man walks, a dog might be able to follow him by the scent.

It was hereupon observed, that the vapours, that perspire through the skin, make a kind of atmosphere about a man and other creatures; and thence in cold weather those vapours being condensed into water become visible, as was more visible in the breathing of a man or other creature. Hence it was conjectured, that the wearing of an oiled case upon a hat would make the hat within very wet; as also the wearing of cap of salve or lead.

Hereupon it was suggested by Mr. Hooke, that probably the healing of plaisters might be from nothing else than the keeping of the air from preying upon the tender wounded part, and from keeping in the moisture to keep it tender and supple.

The use of the skin of an egg for healing of fresh wounds was also mentioned: as likewise that this was the reason, why a dog heals his wound by licking it, keeping it thereby clean and moist.

Mr. Colwall related, that though the egg skin might be good for healing of green wounds, yet that it is not so for healing of old ones; for that he knew a person, who by wrapping up his finger in it, had mortified it.

By

By the bye mention was made of the foot of a bear, which by STENO was obſerved to be much fuller of glands than that of other creatures: and this was ſuppoſed to be the reaſon, why bears were obſerved to ſuck their feet ſo much in cold weather, as containing a liquor laid up by nature: and it was obſerved, that thereby the fat of the bear waſted.

Mr. HOOKE read a diſcourſe and relation of a voyage made by a gentleman to the top of the pike of Teneriffe, and of the remarkable particulars obſerved there by him; of the water and ice in the cave: of the heat and ſulphur of the caldron at the top: of the cold and penetrating winds: of the clear proſpect of an iſland at a good diſtance: of the continuing of the taſte of wine and ſtrong waters: of the reputed hight, and of the vaſt ſtones, that ſeemed to have rolled down from the top.

An experiment was exhibited, to ſhew how exceedingly ſenſible the air is of the alteration of the degrees of heat and cold. And it was made uſe of to explain how the motion of the muſcles might be effected, ſuppoſing them to conſiſt of an infinite number of ſuch ſmall bladders ſtrung together, as had been ſhewn at the laſt meeting by the microſcope in the muſcle of a crab.

May 4. At a COUNCIL held at Sir CHRISTOPHER WREN's were preſent

Sir CHRISTOPHER WREN, vice-preſident,

Sir PAUL NEILE,	Mr. HENSHAW,
Mr. HILL,	Mr. HOOKE.

It was ordered, that the iron cheſt in the gallery of Greſham-College be opened on the Thurſday following in the preſence of a vice-preſident and any two of the council; and that an inventory be taken of what was contained in it; and that Mr. HUNT provide forthwith convenient padlocks for it:

That Mr. HOOKE treat with Mr. LEM concerning Chelſea-College, and give an account of his proceedings at the next meeting of the council:

That an index be made of all the material things contained in the Council-book by the advice of the ſecretaries; and that a reaſonable allowance be made to a fit perſon to do the ſame: And,

That Mr. HENSHAW, Mr. HILL, and Mr. HOOKE, be deſired to go to Chelſea College, and to get a ſurvey of it ſometime before the Thurſday ſev'nnight following.

May 9. At a meeting of the SOCIETY, Mr. HENSHAW, vice-preſident, in the chair.

The minutes of the laſt meeting being read gave occaſion of much diſcourſe concerning reſpiration, and of what uſe the air might be for continuing ſenſe, motion, and life.

Sir JOHN HOSKYNS was of opinion, that the use of the lungs might be to alter, prepare, and dispose the air so, as to separate a part thereof, and make it fit for mixing with the blood, as it passed through them, somewhat analogous to those operations, which are performed by other viscera upon other juices of the body; and for separating also at the same time apart from the blood, as the liver separates the gall, the kidneys the urine, &c.

The vice-president was of opinion, that a principal use of the lungs is for the promoting of the circulation of the blood.

It was objected to this, that the motion of the lungs was not at all necessary to the circulation, because a dog could live, though his lungs were kept motionless, by being continually blown up and kept extended by a pair of bellows: that a dog would be kept alive, though the lungs were not kept fully extended, provided there were a continual blast of air, that passed through them: and farther, that a creature would be stifled and die, though his lungs moved, if it did not breath fresh air.

It was therefore concluded, that the principal use of respiration is for the mixing the nitrous part of the air with the blood; which part of the air being once spent and separated from it, the remaining part thereof is altogether useless for that purpose.

To this it was objected, that if there were such a constant and continual necessity of fresh air, how comes it, that the fœtus included in the secundine, as had been lately mentioned, would continue to live, though it had no fresh supply of fresh nitrous parts of the air from the lungs, which would not move at all?

And Mr. HENSHAW mentioned the person in Sweden, of whom there is a fuller account in the books of the Society, who being drowned and frozen up in ice for a considerable time, was afterwards dug out, thawed, and brought to life again, and had been seen by many in Sweden, with whom Mr. HENSHAW had spoken.

Mr. COLLINS cited upon this occasion PECHLINUS's history.

It was farther supposed, that the greatest transpiration of the body was made by the lungs; and that some creatures scarce sweat at all. Whereupon Dr. AGLIONBY suggested, that the drivel of a dog heated with running is not ordinary saliva, but seems to be the sweat of the dog mixed with it.

Upon the mention of the relation, read at the last meeting, of the journey to the top of the pike of Teneriffe, several debates arose concerning the hight of the clouds and the nature of them.

Sir JOHN HOSKYNS observed, that according to this relation the clouds were as

as high as the top of the pike; and that they sometimes covered it, and made the earth very moist and clammy.

Dr. WALLIS and some others affirmed, that they had ridden through clouds at the tops of hills, which there appeared a mist; but both before they entered it, and after they had passed it, it looked like a cloud, and was really nothing else.

After this a Latin letter was read from THEODORUS KERCKRINGIUS sent to the president, and dated at Hamburgh, 4th February, 167⅞ [u], returning his grateful acknowledgments for the honour and favour done him by his election into the Society, and declaring his desire and readiness to serve their design to the utmost of his power.

The experiment appointed for the next meeting was the trial of the mercurial experiment at the column on Fish-Street-Hill.

May 30. At a meeting of the COUNCIL were present,

Sir CHRISTOPHER WREN, vice-president,

Sir JONAS MOORE,	Mr. HALL.
Sir JOHN LOWTHER,	Dr. HOLDER,
Sir JOHN HOSKYNS,	Mr. HILL.
Sir PAUL NEILE,	Mr. HOWARD,
Mr. HENSHAW,	Dr. KING,
Mr. COLWALL,	Dr. WHISTLER,
Dr. GREW,	Mr. HOOKE.

It was ordered, that Sir JOHN HOSKYNS, Mr. HENSHAW, Mr. HILL, Dr. GREW, Mr. HOOKE, or any two of them, be a committee to consider of the best way of disposing of Chelsea-College; and that they have full power to treat and agree concerning the disposal of the said interest to the best advantage of the Society in their opinion: and that Mr. HOOKE do from time to time appoint the meetings of the said committee, and accordingly send notice thereof to the members of it.

At a meeting of the SOCIETY on the same day,

Mr. HENSHAW, vice-president, in the chair.

The minutes of the meeting of May 9, being read gave occasion of discoursing concerning the reviving of persons, who had been drowned for a considerable time: upon which subject it was alledged, that PECHLINUS [x] had written a long discourse, of which the Society had received a particular account from Monsr. STIERNHELME the resident of Sweden.

[u] Letter-book, vol. viii. p. 31.

[x] NIC. PECHLINUS, whose book *de Aeris & Alimenti defectu* was printed at Kilon in 1676.

Sir

Sir JONAS MOORE gave an account, that Mr. EDMUND HALLEY, who went to the island of Saint Helena, in order to observe the true places of the stars near the south pole, was newly returned to England; and that he had completed his design by having taken the true places of above four hundred considerable stars: that the place of his observation was above a thousand yards higher than the surface of the sea: that by reason of that great hight there were there almost continual clouds and mists, which passed very swiftly: that this mistiness and moisture of the air dissolved the glue of the tubes: that he observed, that these clouds and mists arose immediately out of the sea on one side, and passed over the island, and fell down on the other side: that this mistiness was only over the island, and not on the encompassing sea: that the air was extremely temperate and helpful: and as an argument hereof he related, that a couple having gone over from England to inhabit there, the husband being fifty-five years of age, and the wife fifty-two, the wife was big with child, and ready to be delivered when he came from thence: that the island afforded plenty of wild partridges and turkey-hens: and that the whole island seemed to be one intire rock standing in the middle of the sea.

Sir JONAS MOORE undertook to discourse Mr. HALLEY farther concerning his other observations, and to give the Society an account thereof.

Mr. HOOKE read part of a discourse sent him by Mr. JAMES YOUNG of Plymouth, containing a brief description of the island of Mayo and of the bay in that island, from which salt is brought; together with his observations on a well dug in the sand for the procuring of fresh water; which, though almost incompassed with the sea, afforded notwithstanding a good quantity of water pretty fresh.

With regard to the producing of water by this way, viz. by the straining of salt water through the sand, the vice president very much doubted of it, as being a thing hitherto not known; nor was there yet known any other way of filtration, that would make a separation of fresh water from salt water.

Dr. WHISTLER observed, that all over Holland, Zealand, and West Friseland, where the country lies lower than the sea, there could be no springs found by digging.

Mr. HOOKE then gave an account of some experiments, which he made with Mr. HUNT and Mr. CRAWLY at the Pillar on Fish-Street-Hill, concerning the difference of the pressure of the air at the top and bottom of the column and at several intermediate stations: and he affirmed; that he had found the quicksilver in the tube to stand higher at the bottom of the column than at the top of it by near a third part of an inch; and that he had observed the same to ascend by degrees, as near as he could perceive, proportional to the spaces descended in going down from the top of the column to the bottom: but because the said stations of the mercury were different from one another but very little, and so it was not easy to determine the certain proportions of the one to the other; therefore

fore he proposed against the next meeting an experiment to be tried at the same place with an instrument, which would determine that distance an hundred times more exactly: which instrument also he there produced, in order to explain the manner thereof, it being made upon the same principle with the wheel barometer, but more curiously wrought.

The experiments with his instrument were appointed to be tried at the column upon the Thursday following at eleven o'clock in the morning.

June 6. At a meeting of the COUNCIL were present

Sir CHRISTOPHER WREN, vice-president,
Sir JOHN HOSKYNS, Mr. HALL,
Sir JOHN LOWTHER, Mr. HILL,
Mr. HENSHAW, Mr. HOOKE.

It was ordered, that the treasurer pay to Mr. HOOKE the sum of forty-five pounds for his allowance as curator of the experiments of the Society for a year and half ending the 24th of that instant June.

It being mentioned by Mr. HOOKE, that Mr. JOSEPH LANE, comptroller of the chamber of London, lately elected a member of the Society, desired to be excused from the usual payments thereof, upon his allegation, that he would otherwise be ready to promote the design and good of the Society, and to be assistant to them in matters of law; it was thought fit and ordered, that he should be excused from the said payments upon his subscribing the engagement to perform the other duties incumbent on a fellow of the Society.

It was ordered, that Mr. HOOKE be desired to go to the library at Arundel-House, there to meet Sir WILLIAM DUGDALE, garter king at arms, and to receive his proposals concerning the books of that library, which concern heraldry and genealogy, or the history of the family of Norfolk, which his grace the duke of Norfolk had reserved, when he formerly granted the rest to the Society: and that Sir JOHN HOSKYNS, Mr. HILL, and Mr. HALL be desired to accompany him on the Friday following at three in the afternoon.

At a meeting of the SOCIETY on the same day,

Sir CHRISTOPHER WREN, vice-president, in the chair.

Upon reading the minutes of the meeting of May 30th, a farther discourse was occasioned concerning the revival of several creatures after they had been drowned; as also concerning the reviving of swallows after they had been taken out in clusters from under the ice: concerning which it was affirmed, that Sir GILBERT TALBOT having made particular inquiry into the truth of such relations by special order from the king, he had confirmed those relations.

There

There was read Mr. JAMES YOUNG's account of his obſervations in ſeveral parts of the world concerning the production of ſprings by the ſtraining of ſea-water through the ſands and pores of the earth; whereby he endeavoured to prove from ſeveral inſtances, that ſprings in all places could not have their origin from rain-water, as was ſuppoſed, but more probably ſeemed to be produced by the ſweetening of ſea-water.

This occaſioned a great debate concerning the cauſes of ſprings.

Sir JOHN HOSKYNS related, that the iſland of Walkerin was all of clay; and yet at the bottom of the hills there were great numbers of ſprings of freſh water.

He added, that it was not improbable but that a great quantity of the water flowing from the tops of hills was occaſioned by the frequent miſts there, when there were none in the valley underneath.

He conceived alſo, that one cauſe of the miſts on the tops of hills near the ſea-ſide is the paſſing of the air, which is near the ſurface of the ſea, over the top of the hills; and there by the cold, and the beating againſt the ſame, might be condenſed into water.

He mentioned alſo, that it was not improbable, that though there might not be a , that would ſtrain the water from the ſalt; yet there might be ſome, that might ſtrain the ſalt from the water; and he took notice of ſome unglazed pots of earth, through which it is commonly obſerved, that the ſalt would paſs through the ſides thereof, and ſtick in the form of ſalt on the outſides.

It was objected by Mr. HOOKE, that though it appeared in a dry form, yet that it paſſed through by the vehicle of the water, which being evaporated left the ſalt.

Mr. HENSHAW affirmed, that there was a known way of refining ſalt-petre by tranſudation through earthen pots in ſix hours.

Upon this Dr. CROUNE mentioned the tranſudation of water through the coats of the ſtomach, through which yet the air, which was more ſubtile, would not paſs.

Mr. HOOKE added, that the reaſon of this is from the congruity of the coats of the ſtomach to water, and their incongruity to air, of which there had been many experiments ſhewn to the Society.

He farther added, that there are very different ſalts; ſome, that are aerial, and have a congruity with the air, and would therefore eaſily mingle therewith, and leave the water: and there were other ſalts, that have a greater congruity to

water and other aqueous liquors. And of this nature seem to be volatile or urinous salts, which are readily taken up by the air, especially if the air be assisted by heat. So that if there were a way of rendering sea-salt so volatile, the salt might be separated by sublimation from the water, as well as the water is now sublimated or distilled from the salt.

Sir CHRISTOPHER WREN mentioned, that possibly there might be a way of separating fresh water from salt water, by suffering it to stand and settle in vessels; for that it had been observed, that the top of the water was very much fresher than the bottom; and that by pouring fresh water upon salt, it would remain a good while fresh at the top before the salt would rise thither.

This was seconded by Mr. HOOKE, who affirmed, that he had upon that principle made several weather-glasses, viz. by poising certain bubbles or bottles of glass sealed up hermetically, so as just to sink in fresh water: and that by this means he had found, that by putting salt into such water, or rather gently pouring water upon salt, and putting in the said poised bubble, the same would not sink to the bottom, but remain suspended in the body of the water, at first pretty near the bottom; but at length it would rise higher, according as the salt more and more dissolved in the water, so as at last to float almost at the very top.

Sir JOHN LOWTHER related, that he had a town upon his estate, which was built upon a place, which was formerly sea; notwithstanding which, upon digging wells in the sand (which is the ground, upon which the town stands) they find very good springs of fresh water at eight yards depth; at which place they come to a gravel: that there are antient hills, which may be supposed to supply the springs: that the manner of sinking these wells into the sand was this; first they make a kirb of wood or plank of the exact bigness, which they design the walls of the well: then they lay that upon the sand; and upon that design begin to build a cylindrical wall of bricks two or three feet high: they then dig out the sand from within the said kirb; by which means the kirb and wall sink downwards: then they build the round walls higher, and again undermine the same, till it be again even with the sand; and then raise the walls again and sink the kirb, proceeding in this manner till they have sunk the said kirb to the depth of the spring. He added, that under the said town he had found a coal-mine: that in sinking a well to this coal-mine they found these springs at four fathoms depth, which they endeavoured to keep out; but being not able, they endeavoured to free it from water by engines, and continuing to sink farther till they came to a bed of clay at eight fathoms, they were so overpowered with water, that they were obliged to desist from their proceedings to sink it any farther: but that sinking another well at in the same manner at sixteen yards distance, they found the same sorts of ground and clay as in the former, but without the annoyance of springs; the former well of eight fathoms depth having drained this perfectly dry, though it was full sixteen fathoms deep; which was a successful attempt of his own contrary to the opinion of the miners.

Mr. HALL remarked, that it was a known experiment to run or draw off the fresh

fresh water from the top of the salt water in the brine-pits after rain, the same remaining at the top of the brine without mingling therewith.

Dr. CROUNE related an experiment of his own trial, which was, that by putting a crust of bread on the top of salt-water, and pouring fresh water upon it he found, that they remained a long time distinct without mingling one with the other.

Mr. HOOKE supposed, that there might be a kind of precipitation or rather fixation of the salt out of the brine, by the straining through the sand; it finding therein somewhat of such a nature, that might mix with it, after the same manner as oil of tartar doth with oil of vitriol; from the colluctation of which might be produced a kind of salt perfectly insipid. And to make this the more probable, he related it as a known observation at the salt-urns, that the boiling of the aforesaid brine (which had been made by the evaporation of sea-water by the heat of the sun in the brine-pans) constantly separated from the same (though perfectly clear when put into the square iron boiler) great quantities of pure insipid white sand at the four corners of the said boiler. That the reason of this separation here he supposed to be the avolation of that volatile salt, which kept the said sandy substance dissolved and floating in the brine: that there was such an avolation of volatile salt, he argued from the strong smell of spirit of salt in the boiling-house.

Upon this Sir JOHN LOWTHER related, that in making salt in Lancashire upon the river Wy, they take the sand, and steep it in water; by which means they dissolve a great deal of salt out of the sand; then separating the said water from the sand, they boil it up into salt.

Mr. HENSHAW affirmed, that one might, by some drops of clear oil of tartar put into very clear spring-water, separate a small quantity of stony or earthy matter, sometimes mud, sometimes chalk, sometimes earth and sand.

Dr. CROUNE mentioned the keeping gold suspended in aqua regia, and precipitating it with oil of tartar.

Sir CHRISTOPHER WREN supposed, that sea-water might be made fresh by percolating the pores of sea-plants. To which it was answered, that most of those plants tasted of salt; and that there was not yet known any substance, that would retain the salt, and let the fresh water strain through.

It was suggested, that trials might be made with several substances, to see whether there were any, that would make the water at all fresher.

Dr. CROUNE mentioned the experiment, which had been formerly made by Mr. BOYLE, of making the water rise by filtration to a considerable hight above the surface of the water in the vessel.

Upon which it was desired, that some experiments of that kind might be shewed at the next meeting.

A letter in Latin was produced, written by Dr. E. Leichner to Dr. Grew, secretary of the Society, written at Erfort, 18th May, 1678 [y]: but it being long, the reading of it was referred to the next meeting.

Mr. Hooke likewise produced a discourse of Mr. James Young of Plymouth, desiring a licence for printing the same; which was referred to another meeting.

Mr. Hooke mentioned an experiment for examining the gravitation of the air at several hights above the surface of the earth.

June 13. At a meeting of the Council were present

Mr. Henshaw, vice-president,

Sir John Hoskyns,	Mr. Hill,
Sir John Lowther,	Mr. Hall.

It was ordered, that Mr. Hall and Mr. Hooke attend the duke of Norfolk, and intreat him from the Society, that since his grace was then pulling down his house, he would be pleased to suffer the library, which he had bestowed on the Society, to be removed to Gresham-College, where there was a room provided for it; and that they also deliver to the duke the catalogue of that library: And,

That the tiles and timber of Chelsea-College be taken down, and secured in some place near the same; and that Mr. Henshaw be desired to direct some person to go about the pulling it down forthwith.

June 20. At a meeting of the Society,

Mr. Henshaw, vice-president, in the chair.

A letter in Latin from Monf. Bullialdus to the Society, dated at Paris, 25th May, 1678, N. S. [z], was read, wherein was contained an account of his observations made of the occultation of Saturn by the moon, 27th February, 167$\frac{7}{8}$, after sun-set; together with his calculation thereof from the Philolaic tables, by which he found, that those tables and the heavens differed nineteen minutes; and likewise his calculation of the same by the Rudolfine tables, by which he found, that it ought to have been begun then, when by his observation he found it to be quite past: which he ascribed partly to a fourth inequality of the moon, which he conceived not to be yet reduced to a theory; and partly t the discrepancy of the motion of Saturn from the theory of it; which was

[y] Letter-book, vol. viii. p 34.

[z] Letter-book, vol. viii. p. 42. It is printed in the Philosoph. Transact. vol. xii. n° 139. p. 969. for April, May, and June, 1678.

found

found to be slower than the Rudolfine tables not less than a degree and a half; and in his no less than one third of a degree. He mentioned his design of rectifying those tables as soon as Mr. HEVELIUS should publish his observation (which, he said, would be within a year) if his life should be prolonged, which was already advanced to the seventy-third year.

It was ordered, that this letter should be answered, and the respects and kind acceptance of the Society signified therein; with a communication to him of what astronomical matters had occurred, and their desire, that he would continue his correspondence.

A letter in Latin of Signor FRANCISCO NAZARI to Dr. GREW, dated at Rome, 1st May, 1678, N. S. [a] was read, wherein he testified his extraordinary respect for the Society, and his earnest desire to be serviceable to it by his correspondence, and sending them an account of whatever should occur relating to philosophy.

A third letter in Latin was read from Monf. HUYGENS to Dr. GREW, dated at the Hague, 6th June, 1678, N. S. [b] in answer to the Dr.'s letter, and expressing Monf. HUYGENS's desire to be informed of the inventions and proceedings of the Society, as he had formerly been by Mr. OLDENBURG, and promising in return to communicate to them whatever he should think worthy of their notice. He added, that he had of late employed some thoughts about improving microscopes; being prompted thereto by the discovery of those animalcules *in semine animali* made, by one HAMMIUS, a student at Leyden, which animalcules he, Monf. HUYGENS, had often seen.

It was ordered, that care should be taken to answer this letter, and to continue this correspondence with Monf. HUYGENS.

The minutes of the last meeting being then read gave occasion to discourse farther concerning the nature of the air, and of the vapours raised up into it by heat.

Mr. HENSHAW related the manner of making the experiment of condensing the said vapours out of the air by putting ice and salt into a glass tapered downwards, and ending in a point, and then suspending it in some place; where a considerable current of the air passes by. For by that means the vaporous parts of the air will be condensed by the exceeding great cold of the vessel, and trickling down by the sides will drop into a receiver placed underneath the tapering end a pretty quantity of water in a little time.

This was confirmed by Dr. CROUNE and others.

Mr. HOOKE related an observation of the like nature, which he had made in the year 1665, in a deep well of one Mr. CLARKE near Banstead Downs, of

[a] Letter book, vol. viii. p. 63. [b] Ibid. p. 50.

three

three hundred foot depth[e]: into which having, in the time of a very great frost and exceeding cold wind, which happened about Christmass, let down a bottle with spirit of wine so cooled by the air above, the same, when pulled up again, appeared all covered over with great drops of dew: besides which a great many drops of water were observed to be run off from the bottle into the scale, in which it stood: which by him was attributed wholly to the warmth and vaporousness of the air at the bottom of the well and the exceeding coldness of the bottle let down, which condensed the vapours of that air into water.

Mr. Henshaw and Dr. Croune mentioned the reaking of well-water in frosty weather, which was attributed to the warmth of the water and coldness of the air.

Mr. Hooke conceived, that this was occasioned partly by the coldness of the air condensing the steams, which continually rise not only from well-water, but likewise from all other water, when of such a degree of heat; insomuch that all water exposed to the open air, when kept in such a degree of heat, evaporates such a quantity thereof in the space of an hour, though it scarce becomes visible unless in very cold or very hot weather; in very cold weather by the condensation of the steams into a mist; and in very hot by the playing or dancing of the air, as we commonly call the undulation of the rising vapours over rivers.

This also was partly to be ascribed to the keeping in of the vapours of the water in wells by the air of it; which being once satiated would take up no more vapours into it: whence as soon as this water was exposed to fresh air, that was unsatiated, the vapours were taken up more copiously by it. This sufficiently appeared from the damps of wells.

Against this continual evaporation of the air, Dr. Croune alledged an experiment of Kircher: and Sir John Hoskyns affirmed the same to be mentioned by Beregardus in his *Circulus Pisanus*; by which it was evident, that water, though exposed to the air, did not yet evaporate, though kept open for twenty years: which is an argument, that all water does not so evaporate, as was supposed.

To this it was answered, that though there might be such an experiment made and observed, yet that this experiment did not overthrow the former supposition; especially since one necessary circumstance in the making this experiment was, that the neck of the vessel, that contains this water, must be exceedingly long and high, and the hole small, so that little or no change was made of the air next the water; which being once satiated would after that take up no more vapours into it.

Mr. Henshaw mentioned the way of rectifying spirits and volatile salts by very high bodies and heads; to the top of which the spirits and volatile salts would rise; but the watery and phlegmatic parts would not rise near that hight: and that there were some volatile salts, which would rise in a small body sooner and higher than spirit of wine.

[e] See above, vol. ii. p. 69.

Mr.

Mr. HENSHAW mentioned the way of refining ſalt-petre, by mixing with it alum or a quantity of wood-aſhes; by which means the ſea-ſalt, that is ſometimes found mixed with ſalt-petre, is ſeparated from it.

Upon the occaſion of Mr. HOOKE's deſiring a licenſe from the Society for printing an ingenious diſcourſe of Mr. JAMES YOUNG, about the uſe of oil of turpentine in green wounds, and ſtopping blood, &c. it was deſired, that ſome experiments might be made at the next meeting in the preſence of the Society.

June 27. Mr. HENSHAW, vice-preſident, in the chair.

Mr. WICKS [d] brought in and read a paper, delivered to him by ſome Quakers, concerning the great benefit, that would accrue to the nation by the ſetting up and encouraging ſeveral new manufactures, whereby to keep the poor at work. To which the Society returned for anſwer, that their addreſs was more proper to the parliament, the matter not properly lying before the Society.

The letters of Monſ. HUYGENS, Monſ. BULLIALDUS. and Signor NAZARI, read at the laſt meeting, were delivered to Dr. GREW to anſwer them againſt the next meeting.

Sir JOHN HOSKYNS deſired, that the correſpondence with MALPIGHI might be revived.

The minutes of the laſt meeting were read; upon which by the bye Mr. HENSHAW mentioned the thickening of wine upon the ſurrounding it with ſnow: alſo the condenſing of water on the outſide of a glaſs containing wine and ice. He remarked likewiſe, that miſts were obſerved to riſe more from meadows, that lay near rivers, ponds, &c. than from the rivers themſelves.

He farther obſerved, that the diſappearing of ſhips at ſea was often occaſioned by the thickneſs of the air near the ſurface of the ſea, and not by the roundneſs of the earth altogether: as alſo, that FRANCISCUS PATRICIUS had obſerved much the ſame thing upon the Lago di Coma, where by the thickneſs of the air near the water the ſight of a ſteeple on the other ſide of it was often intercepted; which was urged by him as an argument againſt the roundneſs of the earth, though, as Mr. HILL obſerved, very fallaciouſly.

Mr. HILL remarked, that the hundreds of Eſſex were much more healthy in a wet and cold year than in a hot and dry one: the reaſon of which he conceived to be from the more powerful operations of the ſun in thoſe hot and dry years, for the drawing up thoſe noxious vapours into the air, which in other years riſe not at all, but remain in the ground.

Mr. HENSHAW obſerved, that the heat of the ſun produces a much greater

[d] The clerk of the Society.

effect upon the surface of the earth than than upon the surface of the sea: and that hence proceeded those land and sea-breezes in hot countries; the air and vapours over the land being every day more powerfully expanded, and every night more suddenly condensed than over the sea, the earth holds the heat longer, and exhales, when the water has given over.

Mr. HENSHAW added, that there was a volatile salt, which being mixed with the highest rectified spirit of wine would notwithstanding rise and sublime from it before the spirit of wine would rise.

These discourses were occasioned by the question concerning the hight of vapours above the surface of the waters.

Sir JOHN HOSKYNS remarked, that water in glasses, wherein plants, as mint, &c. had been set to grow, would in time grow muddy and foul.

Mr. HENSHAW supposed, that this might be occasioned by the plant's casting forth some excrement into the water; or else by the plant's straining and sucking away the clearer part, and by its leaving the grosser and more feculent part behind; or by dissolving some parts of the plant.

Mr. HOOKE then produced a new microscope made after his directions by Mr. CHRISTOPHER COCK, whereby the objects were exceedingly magnified, and yet appeared very clear. This was viewed by most of the members present with great satisfaction; and the microscope was ordered to be bought of Mr. COCK for the Society's use.

The experiments appointed for the next meeting were the trials upon blood with oil of turpentine, &c.

July 4. Mr. HENSHAW, vice-president, in the chair.

A letter in Latin from Mr. GEORGE HELD to Dr. GREW, dated at Hamburgh, 6th May, 1678 [e], was read, containing an account of the death of Dr. MARTIN FOGELIUS of that city, and accompanying a printed catalogue of his valuable library, which was to be sold by auction.

A letter in Latin from Signor MALPIGHI to Dr. GREW, dated at Bologna, 21st June, 1678, N. S. [f] was read, giving notice of his sending to the Society the second part of his anatomy of plants.

A letter likewise from Mr. HEVELIUS to Dr. GREW, dated at Dantzick, 18th June, 1678, N. S. [g], was read, in which he inquired, whether four of his letters to Mr. OLDENBURG had been communicated to the Society; and whether his books sent to that gentleman had been sold; and he mentioned, that the se-

[e] Letter-book, vol. viii. p. 55. [f] Ibid. p. 49. [g] Ibid. p 51.

cond

cond part of his *Machina Cœlestis*, viz. lib. 2, 3, and 4, would be published within three months.

Dr. GREW was desired to make an inquiry concerning the state of the account of the books of Mr. HEVELIUS, left in the hands of Mr. OLDENBURG's administratrix, and to give the Society an account thereof at their next meeting.

A fourth letter was read, written by JACOBUS PIGHIUS to Mr. HOOKE, and dated at Padua, 10th March, 1678 [h], wherein he expressed the high respect, which he had for the Royal Society, and his great desire of being known to them. He mentioned likewise his esteem for the English in general, and the favour done him by the English students at Padua, in choosing him their pro-syndic for the present year.

It was ordered, that answers to each of these correspondents should be prepared against the next meeting by the secretaries; and that care should be taken to give a brief account of each letter in the Journal-book, as had been done in the minutes of the 20th of June preceding.

Then the minutes of June 27th were read; which gave occasion of discoursing farther concerning plants growing in glasses filled with water.

Dr. CROUNE supposed, that plants would grow in such glasses, though they had no air, viz. though the ambient air were exhausted.

Mr. HOOKE supposed, that no plant whatsoever would grow *in vacuo*, howsoever ordered: and farther, that they would not grow very long in a glass perfectly stopped, though it contained both water and air, provided it had no communication with the outward air to refresh and renew the air: that a plant would be stifled in the manner of an animal, though not altogether so suddenly: but that length of time would make them grow pale, and sick, and die.

Sir JOHN HOSKYNS mentioned the way of whitening plants, by burying the stalks and leaves in the earth: as also that plants would wither and die, if they were kept in close air in a house.

Dr. CROUNE affirmed, that plants would grow in water, notwithstanding they were covered and kept from the air.

This occasioned some debate; and it was ordered, that Mr. HUNT should make trial thereof, whether a plant, from which the air was wholly excluded, would grow at all.

It was farther desired, that some other experiments should be made, whether plants would grow in a pent air.

[h] Letter-book, vol. viii. p. 22.

Mr. HOOKE mentioned an obſervation, which he had ſeveral times made, that ſome of thoſe plants, which had been ſet to grow in glaſſes of water, would after a certain time begin to pine and waſte, and at length be all over covered with ſmall inſects; which in a ſhort time would all be gone, and leave nothing but their huſks behind, ſticking all over the ſurface of the plant; and at the ſame time alſo the plant perfectly dead and withered, as if the plant had been nothing elſe but the nurſe or dam of thoſe inſects, and that the ſpirit or life of the plant had flown away in the inſects and had only laſted till it had brought forth that living animal offspring. He alſo mentioned, that he had obſerved ſeveral other things in plants of the like nature, which ſeemed to hint ſome ſuch theory.

Dr. PELL hereupon called to mind a certain fungus formerly given by him to the repoſitory, which in a ſhort ſpace was all converted into worms, nothing of the muſhroom being left but a little duſt.

This was confirmed by Mr. HOOKE, who had taken notice of that ſtrange metamorphoſis.

Dr. GALE mentioned, that plants would grow, though they were perfectly covered with water ſo, as no part touched the air.

It was further added, that there are ſeveral ſorts of ſea plants, which grow on the rocks at the bottom of the ſea at a good diſtance from the air.

Neverthelеſs it was ſuppoſed, that the air influences ſuch plants; and that thoſe plants would not grow, if they had not freſh air communicated to them by the water.

Hereupon it was obſerved, that plants would wither at the bottom of the river after a long drought, though they were ſtill covered with water: that fiſh would be ſtifled in water, if they were not expoſed to the freſh air, and often ſupplied with freſh water.

Dr. GREW mentioned, that it was common for a ſort of muſhrooms-mould or mother to grow in water cloſe ſtopped up in bottles.

Mr. HENSHAW mentioned alſo the obſervation of moſs growing upon the very ſubſtance of glaſs, and ſeeming to feed upon it, and eat into the very ſubſtance of it.

He likewiſe mentioned the way of making ſpunk out of brown paper by boiling it in ſalt-petre.

July 11. Mr. HENSHAW, vice-preſident, in the chair.

Mr. HOOKE gave an account of the trial of an experiment propounded at the laſt meeting by Dr. CROUNE to be made to ſee, whether a plant ſet in a glaſs

of water will grow *in vacuo*; and he related, that a plant being put into water upon the Tuesday preceding [i], by Mr. Hunt, and set into the receiver of the air-pump, he had endeavoured to keep the air exhausted ever since by now and then drawing out by pumping what air might have gotten in; and that the plant, which was a blade of mint, was observed to be withered and dead.

Hereupon was occasioned a discourse about the use of air both to animals and vegetables, and what animals were observed to live longest in this evacuated space. And upon this occasion, vipers, bees, snails, &c. were mentioned. But the snail was mentioned as a creature the least sensible of the alteration of the medium. Vipers were mentioned to live long in it, yet to be extremely swoln by the expansion of the air in them.

Mr. Henshaw gave some instances of the strange stretching quality of their skins; which some of the members desiring to see, Mr. Hunt was ordered to fit the engine, and to procure a viper for trial at the next meeting.

Dr. Cox desired, that a tortoise might be also tried, it being a creature, that will live buried in the earth a whole winter without air. Others mentioned snails, slugs, grigs, and bees. And Mr. Hunt was ordered to procure as many as he could against the next meeting.

Dr. Cox queried about the slime of eels, whence it should proceed?

Dr. Grew supposed it to be produced by certain glandules under the skin, after the same manner as the glands in the throat eject continually a slime.

Mr. Hooke supposed it rather to proceed from the transudation of the vapours, or sweat, or rather insensible transpiration the eels; which vapours coming into the water condense and convert that, which is contiguous, into a slimy substance after the same manner as the seeds of *oculus Christi* put into water condense the water about them into a gelly. And he mentioned, that he had a way of converting slime again into water.

Hereupon it was debated, whether the skin has distinct pores or not. Dr. Grew was of opinion, that it has distinct pores; which he said he could make visible; that they were placed after the form of spherical triangles; and that he could see the sweat issue out of them.

Mr. Hooke supposed the skin to have no distinct pores, but defined or rather described the skin to be a body consisting of two sorts of substances, the one solid, the other fluid: the solid part a close contexture of infinite small fibres every way interwoven like the hairs of wool in a piece of cloth or felt. And this is the reason of the great aptness, which it had for stretching and shrinking any way; as may be also observed in a loosely woven piece of cloth.

[i] July 9.

The

The other part is a fluid, which fills the interſtices of all theſe contexed fibres. The fluid is compounded of a more gummous ſubſtance and a more watery. The watery part is that, which coming to the outſide of the ſkin is exhaled into the air; by which means the gummous parts are thicker next the air than elſewhere; and if the cuticula be either by fire or other accidental cauſe thickened too much to hinder the watery part from mixing, and propelling through it, the watery part will gather behind it into a body, and make bliſters; or otherwiſe throw it off in ſcurff.

The diſcourſe of eels produced another about fiſh living upon very little food. Dr. Cox affirmed, that he had kept a craw-fiſh in a ciſtern of lead, without any other food than the water, where it had increaſed and grown much bigger.

Sir JOHN HOSKYNS remarked, that it was uſual to feed craw-fiſh; but that there were ſome rivers, in which craw-fiſh would thrive better than in others; mentioning two rivulets in Ouſleworth in Glouceſterſhire, which ran both into one at that place. The one had the pebbles ſpotted with red, the other not. In the former of theſe both trout and craw-fiſh were found in great plenty; but in the other neither.

Dr. Cox affirmed, that craw-fiſh delighted in the ſhallow and gravelly parts of rivers.

Dr. HOLDER mentioned, that eels in Ely River were commonly made bigger and ſweeter, and fed fatter only by being kept in a box with holes, and hung into the Thames, without giving them any other food.

Mr. HENSHAW conjectured, that it might proceed from the fatneſs of the Thames water, which would yield a burning ſpirit after fermentation, as had been often found in ſea-voyages.

Other fiſhes were named, which were ſuppoſed to live upon a very ſmall quantity of food.

Dr. Cox mentioned the whale, which affords the ſperma ceti; that though it has a vaſt mouth and tongue, yet it has an exceedingly ſmall gula; and nothing is uſually found in its maw but ſome ſmall quantity of ſea-weed or alga.

Mr. HENSHAW remarked, that there are great variety of whales; and that the ſperma ceti whale is not found in the northern ſeas.

Mr. HILL took notice, that the anatomy and deſcription of that whale is to be found at the end of Sir THOMAS BROWN's diſcourſe *on Vulgar Errors.*

Dr. Cox mentioned, that he had obſerved, that in a ſcarlet fever the cuticula would peel and fall off much like the caſting of the ſkin of ſome animals.

Here-

Hereupon Mr. Hill affirmed, that ℈i of the Goa ſtone being given to a child ſick of a fever preſently recovered the ſaid child; but cauſed all his cuticula to grow hard like horn and peel off.

Query, whether it were the piedra de cobra?

Hereupon Dr. Daniel Cox mentioned the ſtrange virtue of the ophites or ſnake-ſtone in adhering to any inflamed part during the inflammation, and not falling off till the inflammation be allayed; and that he had ſeen this tried ſucceſsfully on a child the week before.

He related, that there was a certain herb, which being held in the hand only would cauſe a bleeding at the noſe to any quantity, forcing the efflux of blood ſo long, as the ſaid herb was kept in the hand.

Mr. Hill mentioned a certain bone, which held in the hand would preſently ſtop bleeding.

Mr. Henshaw related, that there was a certain Iriſh plant, called by the Iriſh macambay, which being held in the hand only would provoke purging. This account was confirmed by others.

Dr. Daniel Cox related, that there was lately brought from Carolina in America a certain powder, which being ordered duly made a drink, called by the natives Caſſeni; which ſtrangely exhilerated thoſe, who drank it, and freed them from troubleſome fevers for twenty-four or thirty hours after: but that then they more ſunk. He deſcribed the manner of preparing this drink; but promiſing to bring ſome of it to the Society at their next meeting, and to ſhew the manner of making, the deſcription thereof was omitted in the minutes of the preſent meeting.

Upon this the ſtrange qualities of the herb deutroa were mentioned: as alſo thoſe of ſome other plants.

Dr. Daniel Cox related, that there was another ſnake-weed diſcovered, which was an infallible cure for the biting and poiſon of rattle-ſnakes.

Mr. Aubrey related, that there was an herb called terrara, brought over by Sir Peter Colleton from Carolina, and that the ſame grew here in Mr. Johnson's garden; which herb was eſteemed the beſt antidote againſt all manner of poiſons; the virtue of it being kept amongſt the Indians as a great ſecret: but that it was procured by one, who married an Indian king's daughter. This was ſaid to be mentioned in the hiſtory of the Antilles, and called *herbe aux fleſches*.

Mr. Henshaw remarked, that Garcilasso de la Vega in his hiſtory of Peru mentions how they make their poiſon for poiſoning their arrows and darts, viz. by ſticking them into human fleſh hung up till it be rotten and putrified.

He

He alſo gave an account of a boy, who thruſting his thumb into the corrupted fleſh of one executed, was like to have loſt his arm by a gangrene.

He alſo took notice of the ſtrange effects related of the poiſoned arrows of atchin; which by touching the blood without the ſkin would preſently turn it yellow: and this yellowneſs would ſpread; and if it get within the wound, would kill the perſon: by which it was known whether the poiſon was right.

Mr. AUBREY related, that dogs licking the ſanies of one hanged in chains near Kenſington were poiſoned and died; and that a man wearing the ſhoes, which had been taken off a malefactor's feet after he was rotten, had his feet rotted off.

Mr. HENSHAW related, that there was an arbutus, called in Spaniſh *madrones*, which was of the nature of deutroa; the fruit of which would make thoſe, who eat it, as it were mad or drunk for a time; and that the continuing to eat it would in time make them ſottiſh and fools.

Dr. DANIEL COX related, that BACON, who at his firſt going into America, had been very curious in making obſervations on animals as well as plants, had given to him a deſcription of certain animals, that were found in a very large plain or champaign country, lying between Hudſon's Bay and Calefornia, in vaſt numbers or herds. Theſe at a certain time of the year ſhed their wool or coats, in which was a very fine fur or wool; and the wind blowing gathered it together into great heaps or cakes. Theſe were ſuppoſed by Mr. HENSHAW to be a ſort of Indian goats, called by the Spaniards *vaccuncos* or *quercanadoes*, and were deſcribed by DE LAET. He added, that he was confident, that there was no north-weſt paſſage; and that he could demonſtrate that Hudſon's Bay and the South Sea were a thouſand miles diſtant.

Dr. DANIEL COX related an experiment and obſervation of his made upon ſnow-water, viz. that evaporating or boiling away about forty or fifty gallons to one, he found it of a lixivial colour. This he let ſtand for ſome months; after which the liquor began to ſhoot into *ſtiriæ*, which ſtuck all about the inſides of the glaſs in the form of ſtars, with many points of a greyiſh colour, though the ſnow was very pure. This, though in the form of a ſalt, was not ſalt, but a kind of a fibrous ſubſtance. He remarked alſo, that nitre received from ſpirit of nitre and alkali will ſhoot into hollow hexedrical figures more curious than common nitre, and form alſo ſtars of ſix points.

DAVID HANNISIUS, library-keeper to the duke of Hanover, and JOHN VANDE BEMDE, Eſq; were propoſed as candidates by Mr. HAAK.

Dr. GREW produced, as received from Mr. GEORGE HELD of Hamburgh, a catalogue of the library of Dr. FOGELIUS of that city; together with a printed ſheet, intitled, *Programma in funere nobiliſſimi viri D. Martini Fogelii, Phil. Med. Doct. & P. P. in Gymnaſio Hamburgenſi.*

July

July 18. Mr. HENSHAW, vice-president, in the chair.

An experiment was shewn, of putting an eel into the exhausting engine; which being made staunch, the animal presently died.

Upon discoursing about the food of fishes, Dr. CROUNE related, that fishmongers never find any thing in the maws of salmon. And that a lady, who had been very inquisitive in that kind, had observed the same: but that the contrary was observed in most other fish.

Dr. GREW remarked, that the guts in salmon placed round the stomach answering the *intestinum cæcum* in other animals were very full, though the stomach were empty.

Sir JOHN HOSKYNS related, that there was one sort of whale towards the north, that was reported to feed upon flies; vast quantities of which had been found in the stomachs of those whales: and that their fins seemed to serve for the straining of the flies from the water.

Mr. HOOKE gave an account of the structure of the mouth and fins of that whale, which was cast on shore at Greenwich about twenty years before.

He also mentioned a late relation, which he had seen printed in Low Dutch, of a voyage to Spitzbergen or Greenland, wherein was a description of that sort of whale, together with pictures of them.

Mr. HENSHAW affirmed, that salmons feed upon flies.

The bishop of Chester [k] remarked, that he had a dish of fish, which had been taken very whole out of the maw of a large fish; that they eat very well; and that they were a sort of flounders.

A discourse was then occasioned about poisons.

The bishop of Chester related, that Dr. HARVEY was of opinion, that a man might be saved, though shot with a poisoned dart, if a very strong ligature were made above the wound immediately, and the mortified part below the ligature were cut off presently. But it was thought by others, that this means would not be effectual, if at least the poison were so violent as was reported, unless a ligature were made before the person was wounded by the dart.

Sir ROBERT SOUTHWELL mentioned the trial of the Florentine experiment, viz. that of oil of tobacco, the black heavy oil, that sinks to the bottom in distillation, upon a chicken, related by Sir JOHN FINCH; of which the Society had elsewhere an account, and had formerly made many trials.

[k] Dr. PEARSON.

Sir JOHN HOSKYNS related, that a good quantity of fair water was the best antidote to this poison of tobacco oil.

Dr. CROUNE related, that he had been informed of an English merchant, who had been told by the present king of Macassar, that neither himself nor his father knew any thing concerning such poisons, as they were related to know: but that he had been told, that his grand-father knew much of poisons.

Dr. HOLDER related, that he had known the oil of tobacco made by blowing the smoke upon one's nail, or a knife, being put upon lint, and stopped into the hollow of a rotten tooth, to cure the tooth-ach.

Mr. HOOKE remarked, that Sir CHRISTOPHER WREN had formerly told him, that he knew a maid-servant by the use of that medicine cast into convulsions, which had like to have cost her her life.

Dr. CROUNE related, that he had been informed by Mr. WHITECHURCH, who had lived some time in India, that mountebanks * * [1].

Sir ROBERT SOUTHWELL observed, that he had been informed, that the best remedy against poisoned arrows was presently to eat human excrements.

Mr. HOOKE mentioned the odd effects, that were wrought upon the children of a poor woman, who used to gather physical herbs for Mr. DRINKWATER, by eating some henbane, which they had mistaken for parsnips: that they all fell stark-mad, but were cured in some short time by the said Mr. DRINKWATER, by the taking of alexipharmics and sweating.

CHARLES STEWART, Esq; son of Sir NICHOLAS STEWART, was proposed candidate by Dr. HOLDER.

Upon occasion of a discourse, which was about the breadth of the north part of America, and of the nearness of the South Sea to Hudson's Bay, Sir ROBERT SOUTHWELL remarked, that in Sir WALTER RALEGH's time it was thought, that the South Sea was not above forty or fifty miles from the North Sea: and that he had seen it so described in a map; which was the reason, that in the patent of Virginia the king had granted the country from sea to sea.

July 25. Mr. HENSHAW, vice-president, in the chair.

Dr. GREW read several Latin letters, which he had prepared for answers to correspondents.

The first was to Mr. HEVELIUS, in answer to a late letter of that gentleman, desiring to be informed of the state of the account between him and Mr. OLDEN-

[1] This minute was not completed.

BURG

BURG deceaſed, with relation to ſome books of the former ſent over to the latter.

The ſecond to Signor MALPIGHI, about the expectation of the Society of his farther diſcourſe on vegetables:

The third to Monſ. HUYGENS:

The fourth to Monſ. SLUSIUS:

The fifth to Monſ. BULLIALDUS:

The ſixth to Signor NAZARI: and

The ſeventh to Mr. HELD of Hamburgh.

It was ordered, that Mr. WICKS ſhould make copies of all theſe letters in the Letter-book [m].

A letter from Monſ. LEIBNITZ, dated at Hanover, was read; and Dr. GREW was ordered to prepare an anſwer to it againſt the next meeting.

Sir JONAS MOORE read part of a letter of Mr. TOWNLEY, ſent to him from Paris, containing an account of what BORELLI was doing, in order to the improving of teleſcopical object-glaſſes [n]: as alſo about ſeveral new experiments of changing colours by tranſparent liquors: of Dr. TABOR's ſucceſs in curing agues: and of the death of Monſ. DE CHALES, the author of the *Curſus Mathematicus*.

The minutes of the laſt meeting were then read; whereupon by the way Mr. HILL mentioned, that he had been informed by a fiſhmonger, that he had found the ſtomach and guts of a ſalmon full of graſs, and of another full of fiſh-bones.

The vice-preſident, upon the mention of whales, remarked, that there were reckoned by ſome authors near fifty ſorts of the cetaceous kind.

Upon occaſion of a diſcourſe about poiſons, Mr. HOOKE mentioned an account, which he had from a Virginia merchant, who had lived long in thoſe parts, and had been very curious and inquiſitive into all ſorts of natural curioſities; that the only certain cure of the venom of the biting of a rattle-ſnake was a certain ſubſtance found in the wild walnut-tree, called by the planters the hilcanes-tree, being a kind of ſpunk, but called by the planters punk. It grows within the body of the tree, and is found by a kind of black hole or navel in the tree; which the planters obſerving, they preſently cut down the tree, and take out the ſaid ſubſtance, and preſerve it with very great care, being of ſo ſovereign a virtue, beſides

[m] They do not appear in that book.

[n] See Philoſophical Tranſactions, vol. xii. n° 140. p. 1005. for July and Auguſt, 1678.

its other uses for kindling fire, which it catches most readily. The way of using it is thus: as soon as a person finds himself bitten, he immediately takes his flint and steel, and some of this punk, which he always carries about him; and kindles it, and applies the burning punk to the place bitten; and there keeps it burning till he feels the fire (which he will not presently do, because the part bitten will immediately after grow mortified and senseless;) and thus he continues it as long as he can endure it: which will certainly cure him without any other after-symptoms; which if the remedy be not presently applied, are very terrible, and often fatal. In confirmation of which last circumstance, the same person had informed Mr. Hooke, that he knew a man, who had been bitten by one of those rattle-snakes in his finger whilst he was hunting a hare in the woods, having thrust his hand into a hollow tree, where by the baying of his dog he supposed that a hare had sheltered itself. He being bitten, immediately found his hand and arm extremely swoln, with great pain; and then the whole wood seemed to him to turn round; and presently after to be all in a flame: upon which he fell down, and remembered nothing farther. Being within a short space of time after found by some of his friends by means of his dog, he was carried home on a ladder senseless, and by means of a chirurgeon not far distant was so ordered, that he recovered without the loss of his life; but it was three quarters of a year before he was well; and he lost his hair and nails, and his skin peeled off, with many other dreadful symptoms.

Mr. Hooke mentioned likewise, that he had been informed by Mr. Hodges of Moorfields, that he had known a man, who had cured himself of the pain and swelling of the gout, by applying upon the place quick lime-stones, while they were slacking.

Mr. Hooke, upon this occasion of the growing of the spunk within the body of a tree, said, that it seemed somewhat to resemble the rot in a tooth, which he had observed to have a certain black substance, which covered the surface of the hollowness thereof, which began generally from a small hole in the outside thereof, and so spread itself like a mushroom into the more spungy substance within the outward hard crust.

Mr. Henshaw supposed it to be rather a worm, which having corroded the outward crust continued to corrode the inside thereof: and in confirmation of this he added, that he had seen a woman extract worms from a hollow tooth by the help of a sharpened quill.

Others mentioned, that the same thing was done by the help of the fumes of henbane seeds taken into the mouth; whereby the saliva falling into a basin of water held underneath, would discover several living worms, supposed to issue either from the gums or teeth.

Mr. Melling produced a small worm, which he had found in New River water, about six inches long, of the bigness of a horse-hair. It was viewed by several

several small single microscopes of his own making, and found to be alive, and to have a head somewhat like an eel.

August 1. The president, Sir JOSEPH WILLIAMSON, in the chair.

Dr. GREW read an answer to Monf. LEIBNITZ; which answer was ordered to be copied by Mr. WICKS into the letter book [o].

Mr. HOOKE read the minutes of the last meeting; and then produced a piece of punk given him by the Virginia merchant, who had acquainted him with the former relation and description of it. It was a very light spungy substance, and seemed to be no other than the substance of a fungus or mushroom. The colour of it was brown; and it readily took fire, and would continue to burn till the fire was stifled, but seemed not to burn very fiercely.

Upon this occasion mention was made of the moxa of the East Indies, which cures the gout by the application of it burning to the part affected; and which seemed also to be a kind of spunk.

Sir CHRISTOPHER WREN remarked, that it was probable, that the cures of both might be effected by the heat of the fire, and not by any peculiar virtue in either the moxa or the spunk.

Another member supposed, that it was the heat also of the limestone, which had effected the cure of the gout mentioned in the minutes of the last meeting.

Some mention was likewise made of cures done by the natural heat of living bodies outwardly applied.

Sir CHRISTOPHER WREN observed, that the raising of a blister would cure the stinging of wasps.

It was also added, that the head of a red-hot iron would cure the biting of adders: and that there was a man, who sold adders, who had several times shewn the experiment, and would at any time do so to those, who were curious, for a reward in money.

Mr. HOOKE read a discourse of his, concerning the nature and power of springs and electrical bodies, giving not only an account of the nature and power of all sorts of springy bodies, and the several phænomena thereof, but likewise of the reasons and grounds of those phænomena; as would more at large appear in the discourse itself, which he designed speedily to publish [p].

[o] It is not inserted there.

[p] It was published at London, 1678, in 4to. under the title of *Lectures de potentia restitutiva: or of spring, explaining the nature of springing bodies.*

He

He then exhibited two experiments in order to prove his said theory; the one with a tubical spring of brass-wire, and the other with a spiral spring of steel, being the spring of a watch.

Mr. MELLING produced the hair-worm, which he had shewn at the last meeting, now preserved in spirit of wine in a cylindrical glass-pipe hermetically sealed, it having since died; wherein the head of it was plainly to be seen by the help of his small single microscope.

August 22. Mr. HENSHAW, vice-president, in the chair.

Mr. HOOKE delivered to the Society an antient urn of glass, taken up in Spittle-fields upon digging cellars there, presented by Sir CHRISTOPHER WREN for their repository. There was this remarkable in it, that it seemed to be made after quite another manner than that used by the present workmen in that art, it having no place at the bottom thereof; nor any visible sign how it could be held, whilst the lip and handle thereof were joined to the body.

Mr. HOOKE shewed the experiment of the springing of a string of brass-wire, about thirty-six or thirty-seven feet long, extended by weights hung at the lower end thereof; and he made it evident, that the said string extended proportionably to the weight, that was hung to it at the bottom: that is, that one weight extended it one length, two extended it two, and three extended it three spaces or lengths.

At this meeting were present Monf. EZEKIEL SPANHEIM, envoy from the elector Palatine, and his brother FREDERIC, professor of divinity at Leyden.

After the exhibiting of Mr. HOOKE's experiment, Sir ROBERT REDDING addressed himself to the vice-president and the rest of the Society present, acquainting them, that his grace the duke of Norfolk had desired him to * * [q].

Mr. HOOKE then shewed to the envoy SPANHEIM and his brother, the small animals discovered in pepper-water by the help of a microscope.

August 29. The president in the chair.

His grace the duke of Norfolk being present at this meeting, renewed the declaration of his gift formerly made to the Society of the Arundelian library; and also gave his consent and direction for the removal thereof into the possession of the Society: and that they should have liberty to exchange such books thereof, as were duplicates, or which they should think not so proper for their use, for others of equal value, which they should judge more pertinent to their design. He declared likewise, that the books formerly reserved by him concerning heraldry were the only books, which he still excepted out of the said donation, having

[q] The rest of this minute is not entered in the Journal-book, vol. vi p. 124.

made

made a promiſe of them to the college of heralds. His grace added, that Sir WILLIAM DUGDALE had preſented him with a catalogue of ſuch books, as he in the name of the heralds had deſired for that purpoſe. But upon peruſal of the ſame finding many of them to be ſuch, as did not ſo properly belong to the buſineſs of heraldry, the duke was deſirous, that Sir ROBERT REDDING and Mr. EVELYN would peruſe the ſaid catalogue, and conſider what books therein mentioned were ſuch, as concerned heraldry, and were moſt proper for the uſe of the college of heralds, and what might be more proper for the uſe of the Society, and to moderate and adjudge the matter between the ſaid Society and college. But it was his grace's farther pleaſure and deſire, that in caſe the Society ſhould be diſſolved, (which it was his deſire and hope they never would be) the ſaid library might revert to his heirs.

The Society by the mouth of the preſident returned his grace their moſt humble and hearty thanks for this his truly noble preſent: and ordered Mr. HOOKE to take care, that the determination of the matter between them and the college of heralds might be made with all convenient ſpeed; and that thereupon the books ſhould be forthwith removed to Greſham College.

Mr. HENSHAW moved, that a fair catalogue of them might be made, to be delivered to the duke to remain in his grace's cuſtody:

As alſo, that all ſuch books, as ſhould be received in exchange for others of the ſaid library, ſhould have his grace's name ſtamped upon them, and kept with the reſt, and to be owned to be his grace's preſent.

Mr. HOOKE produced and read the preface of a book, which he had procured to be tranſlated out of High Dutch, containing a deſcription and natural hiſtory of Spitſbergen or Greenland, written by one * * of Hamburgh, who had been there himſelf, and, upon occaſion of queries ſent out of England, had made it his buſineſs to inform himſelf more particularly concerning all matters therein deſired; and by the help of Dr. FOGELIUS of Hamburgh, who had tranſlated and delivered thoſe queries to him, had compiled and methodiſed the ſame; and for the better illuſtration of all particulars, had added a great many copper cuts, containing the pictures of the moſt remarkable particulars, viz. of the whales and other fiſhes, together with thoſe of the animals, birds, plants, &c. Mr. HOOKE added, that he had delivered the ſaid book to a German, in order to have it tranſlated into Engliſh.

Sir ROBERT SOUTHWELL hereupon obſerved, that there was a kind of whale in the oil of which was ſo penetrating, that it was very difficult to find veſſels to hold it without leaking.

He mentioned alſo an experiment made upon a ſquare plate of glaſs, upon which a ſtring was ſtretched to a certain tone, which tone upon the application of heat was altered.

The

The duke of Norfolk mentioned, that the earl of Aylesbury had heard his child make a noise whilst in his lady's womb.

Sir ROBERT SOUTHWELL mentioned a relation of a woman of Lorraine, who having been a very long time with child without being delivered, had in despair killed herself. Whereupon being opened, it was found, that the child within her had been dead for a considerable time; and that one part of the body of the said child was found petrified by the waters in her womb.

Upon occasion of a discourse on freezing, Mr. HENSHAW mentioned, that upon freezing of wine, the part, which remained in the middle, would be very strong and spirituous; but that the other parts, that were frozen, would be waterish and almost tastless: and that the greatest part of the wine froze and swelled out of the bottles, thrusting out the cork before it.

Dr. CROUNE mentioned, that the time of freezing was almost instantaneous.

Mr. HOOKE related the experiment of producing the regular figures by freezing, by mixing snow and salt in the body of a glass vial, and then putting upon the outside of the same a small quantity of the spirit of urine.

Mr. HOOKE was ordered to make what haste he could with the weather-cock, which he designed; as also with a very accurate barometer.

October 31. The Society met again after their adjournment, and Mr. HENSHAW, the vice-president, took the chair.

The minutes of the last meeting were read; which gave occasion to some discourse concerning the petrifaction of human substances.

Dr. CROUNE mentioned that there had lately been a discourse on that subject published by * *; and that it had been answered by * *.

Mr. HENSHAW mentioned, that he had seen the arm of a man petrified at the house of cardinal MONTALTO, called *Villa Peretti*, it being part of the body of a man wholly petrified in the Alps.

Upon reading the remark concerning freezing, Mr. HENSHAW added, that having in Denmark set brandy to freeze in cups, he found, that all the spirituous part thereof was partly wasted, and partly converted into a spongy ice, of a very ill taste; and that it had lost all its strength.

Sir JOHN HOSKYNS related, that Dr. MERRET had assured him, that the strongest wine might be all frozen in the Florentine flasks: the reason of which was conceived to be the extreme thinness of them.

Mr. HOOKE read a letter directed to the two secretaries from Mr. MICHAEL BUTTER-

Butterfield, a mathematical instrument-maker at Paris, dated there, $\frac{8}{18}$th October, 1678 [r], expressing his desire to correspond with them concerning philosophical, mathematical, and mechanical matters; and offering to communicate such things, as he should meet with there of that kind. He mentioned in that letter Monf. Huygens's method of making small globules of glass for microscopes, by sticking powdered glass on the point of a needle with spittle, and holding them in the flame of a lamp of spirit of wine, and afterwards rubbing them with a putty cloth: as likewise a level of his own invention, published the year before in the *Journal des Scavans*, together with a farther improvement of it by hanging it upon one point.

He took notice also of some other sorts of levels invented by other considerable persons: and added, that he was making a large silver planisphere for the king of the invention of Signor Cassini, of two feet diameter: that he had lately made for Signor Cassini an equinoctial dial of a foot diameter, with three circles, besides the sliding ring, and two halidades and four sights: that there had been lately made at Paris a piece of clock-work to shew the motion of Jupiter's satellites; but that it was not much approved of: and that himself had not long before made a sliding half quadrant, with a glass of eight inches semi-diameter, of very great use, and easy to be carried.

In this letter were inclosed two packets, one from Monf. Gallet, provost of the church of St Syphorien at Avignon, containing a letter in Latin to the Society [s] and three small tracts; the first his account of the observation of Mercury in the sun; the second his observation of an eclipse of the moon, 17th May, 1677; the third his observation of an eclipse of the sun 11th June, 1678; all three observations made at Avignon.

Monf. Gallet's letter was read, wherein after professing his great respect for the Society, he added his desire of holding a correspondence with them upon astronomical subjects, and promised to send such other observations, as he had hitherto made, and not yet published, and especially those about the diameters of the sun and moon, concerning which he gave some instances relating to the sun's diameters.

Dr. Croune affirmed, that Mr. Rooke had long before used the same way, for taking the diameters of the sun, with that made use of by Monf. Gallet, viz. by computing the time of the transit of its figure made by a forty foot glass.

Mr. Hooke read a relation of a great eruption of fire, which happened in the preceding winter in the isle of Palma, one of the Canaries, given him by a person, who had long resided in the said island, and who was there at the time of the said eruption.

Mr. Henshaw was of opinion, that hot baths were caused by subterraneous

[r] Letter-book, vol. viii. p. 59. It is printed in the Philosoph. Transact. vol. xii. nº 141. p. 1026. for September, October, and November, 1678.

[s] Letter-book, vol. viii. p. 29.

fire, because generally where there are subterraneous fires, there are many hot baths.

Sir PETER WYCHE acquainted the Society, that he was very speedily to go to reside at Hamburg, and professed his desire and readiness to promote the interest and business of the Society in those parts.

Mr. DETHLEVUS CLUVERUS was proposed candidate by Mr. HAAK; and

Mr. WILLIAM PERRY [1] by Dr. MAPLETOFT.

November 7. Mr. HENSHAW, vice-president, in the chair.

The minutes of the last meeting being read, occasion was given of discoursing of cold and freezing; and Mr. HENSHAW affirmed, that by experience he had found, that the coldest weather in Denmark would not freeze a whole bottle of sack.

Mr. HOOKE shewed the planisphere and description of the stars of the southern hemisphere made by Mr. HALLEY. Whereupon Mr. HENSHAW was of opinion, that they would be very acceptable presents to such correspondents abroad, as were lovers of astronomical matters, if the book and planisphere were sent to some of them from the Society: to which the Society agreed; and it was desired, that the secretaries should send one of these books to Mons. GALLET, another to Mr. BUTTERFIELD, and a third to the Abbé de la ROCHE, in the name and at the charge of the Society.

Upon a further discourse concerning hot baths, Mr. HENSHAW was of opinion, that they might proceed from some subterraneous fire, because they are generally found near such places, where those subterraneous fires break out, as in Iceland, and one about Naples especially. And whereas it was urged, that they appeared many times in places, that were far enough from such burning mountains; he answered, that though there might be no appearance of fire, yet there might be some subterraneous fires concealed, that might be the cause of such heat. Dr. CROUNE objected, that such could scarce be supposed without having certain *spiracula* or breathing places near them; none of which being found near our baths, it was difficult to suppose, that there should be any such fire. It was added, that it was possible, that there might be such *spiracula*, which we know not of; at least we do not know what space the subterraneous fire might possess; whether it might not spread some miles besides just underneath the place, where the hollow fountains are; and whether there might not be subterraneous communications between volcano's at a great distance. Mr. HENSHAW added farther, that there were some hundred of such volcano's in the East and West Indies. Sir JOHN HOSKYNS subjoined, that the Dutch had noted about an hundred in their plantations.

Mr. HOOKE remarked, that it was very common to observe a mist hanging about the tops of hills, when the air above, beneath, and round about was clear.

[1] M. A. and fellow of Trinity College, Cambridge.

He

He alſo conceived, that there was no earthquake without a ſubterraneous fire; and that many of thoſe ſubterraneous fires proceeded from parts very deep in the very body of the earth, and not only near the ſurface, like the coal mines in the north, which had been ſet on fire, and had continued ſo for many years.

Dr. MAPLETOFT affirmed, that he had ſeen a coal-mine, which had ſo burned and ſaid, that it was very ſhallow, and but a very little way, viz. about a fathom or two, below the ſurface: that it was not difficult to quench it: that it burnt very ſlowly forward: that he had alſo ſeen the burning fountain in Lancaſhire near Wigan, and conceived it to be an exhalation ariſing from ſome coal-mine underneath.

Hereupon a diſcourſe was occaſioned, concerning the cauſe of the generation of ſubterraneous fires, and how they ſhould be continued without immediate communication with the air.

Mr. HOOKE mentioned ſome obſervations about the generation of fire by rain falling ſuddenly on a ſort of coals, called braſs lumps; as alſo on quick-lime lying againſt deal-timber; both which had cauſed fire. Mr. HENSHAW, Mr. PACKER, and Dr. CROUNE inſtanced in other ſubſtances, that would generate an actual fire, ſuch as hay wet, green graſs heaped up, malt, cotton-wool, roſe-flower leaves, and ſeveral other green leaves and plants.

Upon a diſcourſe concerning the well dug in the iſland of Mayo, Mr. HENSHAW was of opinion, that no freſh-water could be ſeparated from ſalt-water by ſtraining or any filtration; though mention was made of the cups of ivy, which, it was ſaid, would make ſome ſuch kind of ſeparation, viz. that upon mixing wine and water together in one of them, it would ſuffer the water to run through, but would ſtop the wine; which was thought to be the reaſon, why it was ſacred to Bacchus; though others ſuppoſed, that it might be from its uſe at the Bacchanalia for crowning the actors.

It was deſired, that one of thoſe cups might be provided againſt the next meeting, to ſee what might be effected thereby, and whether any thing extraordinary in filtration might be hoped from it.

November 14. Mr. HENSHAW, vice-preſident, in the chair.

Dr. CROUNE acquainted the Society, that the preſident had given him an account, that he had received from Signor MALPIGHI a piece of a plant, together with an account thereof, that he had thereby found out and demonſtrated the circulation of the juices of plants.

The vice-preſident propounded the five following members, viz. Sir JOHN LAURENCE, Dr. CROUNE, Dr. PLOT, Dr. GALE, and Mr. GEORGE ENT, who were accordingly choſen by ballot, to be a committee of the Society for auditing the treaſurer's accounts for the preceding year ſince the laſt St. Andrew's day.

Upon a discourse concerning Bezoar stones, that vast multitudes of them were brought over into England, and that therefore many of them were probably counterfeit, since even in India and the places, where they were found, they were very scarce, and seldom found in those goats, which produced them; Mr. COLWALL related, that there were many of them counterfeits; and that he had tried them by means of a needle heated red-hot; for upon thrusting into them a needle so heated, those, which were counterfeits, would melt and fry; whereas those, which were true, would not.

Hereupon was occasioned a discourse concerning the balls, which are often found in the stomachs of oxen; some of which are found covered with a calculous matter, after the manner of Bezoar stones; others only a great ball of hair very hard, and closely felted together, in a very regular order.

Mr. HOOKE related, that he had often taken the hair of oxen, when they had their coats, and rolling a handful or two of the said hair between his hands, had thereby in a very little time felted them into a very hard and close ball; and that the hairs thereof would naturally range themselves into a most regular and uniform order.

Upon the discourse concerning the eruption, which had lately happened in the isle of Palma, and the river of fire, which ran down from the same, Dr. CROUNE related from Dr. PUGH, that the north side of the Pike of Teneriffe was made up of a matter, which plainly manifested it to have been such a fiery river; it being all melted stones and minerals of that nature: which agreed exactly with the relation lately read at the Society.

Hereupon the burning fountain in Lancashire was mentioned; and Mr. HUNT said, that he had been at the place; and that it would take fire by driving down a stake into the ground, and wriggling it to and fro.

Upon discoursing concerning the actual burning of several places under the ground continually, such as the coal-mines and the burning mountains; Mr. HENSHAW related, that he had been at the Solfaterra in Italy, which lies between two mountains, where he had observed the fire to break out in many places; and that the earth would shake underneath them, and seemed to be all hollow and burning underneath the place where they walked, and had continued so for many ages.

Sir JOHN LOWTHER affirmed, that he had a coal-mine of his own, which was on fire; but it not lying very deep, he had put out the same by digging a deep trench in the ground round about it under ground.

He promised to procure the account of a coal-mine of Sir WILLIAM BLACKET.

The experiment of filtration through a cup of ivy was tried; but it proving so close,

close, that nothing would filtre or pass through it, Mr. HUNT was ordered to procure another cup of ivy against the next meeting.

Upon occasion of the discourse concerning the *lupus marinus*, the teeth of which fish were supposed to be the toad-stones, Dr. PLOT related, that he had a toad-stone, which was not such a tooth, but a real stone, which he had himself found in Oxfordshire. But this was a softer stone, and would not polish as the other stone.

Dr. KING, upon occasion of discoursing of pearls and bezoar-stones related, that he had often found pearls in the stomach of an oister; and conceived them to be generated as the bezoar-stones in the stomach of a goat.

Hereupon Mr. HENSHAW mentioned the way of cleansing pearls, by dipping a foul pearl in aquafortis or spirit of wine; by which means the pearls would presently look white; and then by rubbing it with a cloth all that white coat would come off, and the pearl underneath, if good, would look oriental and clear: but that by often repeating that operation all the shining part of the pearl might by degrees be taken off; and that usually all foul pearls had in the middle of them an opake calculous matter.

He related also the way of making counterfeit pearls used at Bologna and Venice, by silvering or gilding alabaster beads, and dipping them in a size made of fish glew.

Mr. HOOKE related, that he had done the same thing here, by taking ivory beads instead of alabaster, and proceeding in the manner above-mentioned.

He shewed his experiments, which were divers ways of making very round and clear globules of glass for microscopes with great ease.

November 21. Mr. HENSHAW, vice-president, in the chair.

He produced three pieces of stones or different substances; but all agreeing in this, that they were made of several sorts of small pebbles, which were cemented together by a petrified substance as hard as the peebles themselves. They seemed to be of the same kind with some produced at the same time cut into hafts of knives, and polished very well; which seemed as good as, if not to exceed, the Indian agates. Mr. HENSHAW resolved to have them cut and polished in the like manner, and promised then to shew them again to the Society; adding, that he knew where a very great quantity of the same stone might be procured, if there were occasion, viz. in Hertfordshire, not far beyond St. Alban's.

A note signed by Sir JONAS MOORE, vice-president, was directed and ordered to be sent to the porter of Arundel House, to deliver to the bearer Mr. HUNT the eleven books, which were left in the library of Arundel House now pulled down.

Upon a farther discourse concerning bezoar-stones, mention was made of a passage

ſage in Dr. PRIMROSE's book *De Erroribus Vulgi*, that pope SIXTUS QUINTUS had almoſt a cart-load of bezoar-ſtones ſent him; but that upon the examination of them by ſkilful phyſicians, not above three of them proved very good; moſt of the reſt being ſophiſticated.

Dr. CROUNE added, that the Indians found ſometimes a ſort of bezoar-ſtones in the maws of monkies, which they valued at ſo high a rate, as to eſteem them a fit preſent for the Great Mogul himſelf.

Mr. HENSHAW remarked, that there was mention made in LINSCHOTEN's voyages of another ſort of ſtones ſomewhat of the nature of bezoar, and eſteemed every way as good, which are found in the ſtomach of a porcupine, and thence called by the Portugueſe *piedra de puerco*; which are ſmaller, generally about the bigneſs of a gall, and of a dark brown colour. They are frequently made uſe of in feveriſh diſtempers, and have been uſed with good ſucceſs for the ſtrengthening the ſtomach. Being ſteeped ſome few hours in fair water, they yield a greeniſh tincture, which taſteth very bitter.

Hereupon mention was made alſo of a ſtone preſented to Sir ROBERT SOUTHWELL, called *piedra de cobra*, being one kind of ſnake-ſtones, which was ſuppoſed to do great cures by outward application for the biting of ſerpents. It is a factitious ſtone made by the Banians.

Upon a farther diſcourſe concerning the burning ditch in Lancaſhire, Sir JOHN LOWTHER gave a relation of that ſtrange phænomenon, and added ſome remarks not taken notice of before, which he was informed of by Sir ROGER BRADSHAIGH. The ſubſtance of which was, that there was underneath the ground a coal-mine; and that at the place, where the ſteam could be kindled, there were cracks and chaps in the earth; by which it was ſuppoſed, that the damps of the coal mine collected in the cavities thereof, and iſſuing continually from it, did by theſe crannies and chaps of the ground iſſue continually at that place; and thence whenever an actual flame or fire was brought to touch it, it preſently kindled and continued to flame till it was put out.

Mr. HOOKE took notice of the admirable effect, which had been obſerved in it, viz. that it took fire, though the ſteam itſelf were not before ſenſibly warm; which, he ſaid, was more than any other ſteam would do; and that therein ſeemed to be the greateſt rarity of it: whence he conjectured, that it might be the ſame kind of ſteam, which generates lightning. That this ſteam ſeems to be the very ſame with the fiery damp of mines, which will take fire much after the ſame manner, but often with more direful effects, by reaſon that a much greater quantity of the ſaid vapour is collected, and alſo becauſe it is impriſoned and ſhut in with very ſtrong ſides, and hath no poſſibility of venting and expending otherwiſe than by the mouth.

There was much debate concerning the firing of the ſteam and ſmoke of bodies, but there was no inſtance given, wherein ſteams would take fire, unleſs they

had been before heated to a very great degree of heat by an actual fire, and then kindled.

Sir JOHN LOWTHER conceived, that there was a difference between this and other subterraneous vapours in coal-mines; because these flashed like lightning, whereas those of the ditch continued burning. Sir JOHN HOSKYNS mentioned, that there was a sort of earth near Green * *, which being scraped, and straw covered with it, would fire the straw. Dr. ALLEN added, that there was also at the same place such another burning fountain.

Sir JOHN LOWTHER mentioned a fire in the New Castle pit, that in the space of forty years had burnt under ground about a mile in length, and a quarter of a mile in breadth.

He related the manner of working in coal pits so as to support the earth over-head; which was, that they placed wooden props on each side in a row, as they proceeded; and that they often take up one as soon as they had fixed another, leaving the mine only of such a breadth, as they had found by experience would sustain the earth over-head without falling in; and that for the better keeping up of the earth over-head, they usually leave about half a yard thickness of the coal untouched. The breadth of the space, which they could thus trust without wooden props in the Newcastle coal, was not more than three yards or nine feet; but the Scots coal being a stronger and greater coal, would support at least seven yards width; and those places also supported only upon small pillars of 1 ½ foot square of the same coal.

He remarked farther, that Newcastle coal will decay and dissolve with the air and rain, and lose much of its strength in burning.

He was of opinion, that it would be much for the interest of the Newcastle-men, if they would all join together, and work only one mine at a time, since it would be sufficient to serve all England, and that the same charge would serve for draining that mine, which was to serve all, that is now expended upon the same, now it serveth but a sixth part.

Mr. HENSHAW observed, that pearls were called uniones, from their likeness to an onion, which was called *unio* from the single growing.

The experiment exhibited was of an ivy cup filled with wine and water; but upon standing an hour and more, neither seemed to stream through, whereas it was expected that the water should have strained through, and the wine have remained behind.

Sir JOHN LOWTHER was desired to inquire of the president concerning Signor MALPIGHI's letter; and to bring to the next meeting the piece of plant sent

ſent by that gentleman: upon which was occaſioned a diſcourſe about the deſcending of the ſap by the bark; Dr. GREW denying, that it deſcends by that way.

November 28. Mr. HENSHAW, the vice-preſident, in the chair.

The ſtones produced at the laſt meeting by Mr. HENSHAW being ſince poliſhed were ſhewn, and appeared to be as hard, and bore as good a poliſh, as agates; and had a very beautiful variety of colours and ſpots in them.

There was alſo a farther diſcourſe concerning ſome expeditious way of cutting, drilling, turning, and poliſhing the ſaid ſtones into ſeveral ſhapes for various uſes.

Mr. HUNT made his report, that having been to inquire after the books left at Arundel Houſe, he was informed by Sir WILLIAM DUGDALE, that thoſe books were in the cuſtody of Mr. BURBERY, the duke of Norfolk's gentleman. And Dr. GALE reported, that he had ſpoken with Sir WILLIAM, who had propoſed, that as ſoon as he ſhould receive thoſe books, he would ſend the copy of Doomſday-book to the Society.

The minutes of the laſt meeting were read, which gave occaſion of diſcourſing farther concerning ſubterraneous ſteams and fiery damps.

Dr. ALLEN took notice, that there was mention made in Mr. RAY'*s Travels* [a], of a burning fountain in Dauphiny in France, which being ſet on fire would burn very violently, and would ſerve both to fry and roaſt meat; and that the inhabitants near it made uſe of it for that purpoſe.

This gave occaſion to diſcourſe of bituminous ſubſtances. Mr. HENSHAW mentioned, that there was a kind of liquid bitumen, which ſwam upon the *mare mortuum*.

He remarked likewiſe, that ambergriſe ſeemed to be ſomewhat of that nature, ſince it had been often found to float on the ſea: but that amber or *ſuccinum* was of another nature, and was generally found at the bottom of the ſea.

He took notice alſo, that Mr. BOYLE had a method of including inſects in a clear colophony, made by the evaporation of turpentine, which being cold and hard would very much reſemble true amber, and preſerve any inſect put into it very intire.

Mr. HOOKE affirmed, that he himſelf had a way of incloſing an inſect, ſuch as a fly-worm, or the like, in amber artificially, which could ſcarce be diſtinguiſhed from a natural production of that kind.

He added, that he was of opinion, that amber was nothing elſe but the turpentine or reſinous gum of trees, which having lain a long while in the ſea or under

der ground was in procefs of time petrified, or at leaft hardened to that degree, in which it was found: which he was the more inclined to believe from the experiment, which Dr. Daniel Cox had tried upon the earth found fome years before at Iflington; the oil of that earth fmelling perfectly like oil of amber, which was made to have that fmell from the burying of colophony there by a chemift.

Mr. Henshaw remarked, that the fmell of yellow amber, when rubbed, was very much like that of rofemary.

Sir Jonas Moore gave an account of the manner of the firing of a damp in a coal-mine at Lumley, which was with fo great a violence, that it fhook the earth for a confiderable way round about, and carried fome miners, who were going down into it, a very great hight into the air, and blew up alfo aloft into the air all the building, that ftood over and about the mouth of the mine.

Sir Paul Neile hereupon related the manner, in which the cure for thefe kinds of damps was found out accidentally; which, he faid, he had received from Sir William Lampton, the owner of the abovementioned pits or mines; and which was to this effect. The miners having been above making merry, and being almoft fuddled, began to throw firy coals at one another, fome of which falling accidentally into the mouth of the coal-mine, fet fire to the damp, and made it difcharge with a very great noife, and fhaking of the earth. Upon taking notice of this, and the caufe of it, they after a little fpace of time tried by defignedly throwing down burning coals into the mouth of the mine; and prefently falling down flat on their bellies on the ground obferved, that the mine again took fire, and blew up into the air with a great noife. This they repeated feveral times one after another, till they found, that it would fire no more: after which they ventured down into the mine without any fucceeding injury from the faid mine for the remaining part of the day. But for fear left they fhould be farther incommoded by the faid firy damps, they always in the morning, before they go down, endeavour to fire the faid damps, by throwing down lighted coals till the pit will fire no more.

Sir John Hoskyns related, that there was a pit at Brofeley in Shropfhire, where, if a candle were held near to the ground, the fteam or damp would take fire; but if the candle were held higher at a diftance, the fame effect would not follow.

November 30. the anniverfary election-day, there being prefent thirty-three members, and the prefident, Sir Joseph Williamson, in the chair,

Mr. Hooke read the report of the committee appointed to audite the accounts of the treafurer, Mr. Hill, for the preceding year[x].

After which the feveral candidates formerly propofed were balloted for and elected,

[x] This report was omitted to be entered in the Journal, vol. vi. p. 138.

1. FRANCIS ASTON, Esq; proposed by Dr. EDWARD BROWN, by twenty eight votes, no negative.

2. Dr. MAYOW proposed Mr. HOOKE, twenty-seven votes, one negative.

3. Mr. DAVID HANNISIUS proposed by Mr. HAAK, twenty-eight votes, no negative.

4. JOHN VANDE BEMDE, Esq; proposed by Mr. HAAK, twenty-eight votes, no negative.

5. Mr. WILLIAM PERRY, proposed by Dr. MAPLETOFT, twenty-nine votes.

6. Mr. DETHLEVUS CLUVERUS, proposed by Mr. HAAK, twenty-nine votes.

7. Mr. EDMUND HALLEY, formerly proposed by Sir JONAS MOORE, thirty-one votes.

8. Mr. JOSEPH MOXON, proposed by Mr. GEORGE ENT, twenty-seven votes, four negatives.

Mr. ASTON, Mr. BEMDE, Mr. PERRY, and Mr. MOXON were admitted.

The statutes relating to the manner of proceeding in the elections of the council and officers being then read, the Society proceeded to it, Mr. HERBERT and Mr. AUBREY being first chosen to inspect the proceedings of the secretaries.

Eleven members were continued of the council [x].

Mr. COLWALL,	Sir JOHN LOWTHER,
Dr. GREW,	Sir JONAS MOORE,
Mr. HENSHAW,	SETH lord bishop of Salisbury,
Mr. HILL,	Sir JOSEPH WILLAMSON,
Mr. HOOKE,	Sir CHRISTOPHER WREN.
Sir JOHN HOSKYNS,	

Ten members were likewise chosen into the council.

Mr. AERSKINE,	Dr. GALE,
Dr. ALLEN,	Mr. HAAK,
Dr. BROWN,	Sir JOHN LAURENCE,
Mr. CREED,	Dr. MAPLETOFT,
Dr. CROUNE,	Sir THEODORE de VAUX.

The president, treasurer, and secretaries were chosen again for the next year.

[x] These names were omitted to be entered in the Journal, vol. vi. p. 139. but are partly supplied from the Council-book, and a list of the members for 1679.

Between

6

Between this and the next anniversary election died a very learned member of the Society,

THOMAS STANLEY, Esq; only son of Sir THOMAS STANLEY of Cumberlow Green in the county of Hertford, Knt. by MARY his second wife, one of the daughters of Sir WILLIAM HAMMOND of St. Albans in Nonnington in Kent, Knt. by his wife ELIZABETH, daughter of ANTHONY AWCHER of Bourne, in Kent, Esq; and of MARGARET his wife, daughter of Dr. EDWYN SANDYS, lord archbishop of York in the reign of queen ELIZABETH, and sister to Sir EDWYN SANDYS of Bourne, Knt. and GEORGE SANDYS, the celebrated traveller and poet. Mr. STANLEY was born at Cumberlow Green, and educated in Grammar learning at his father's own house under Mr. WILLIAM FAIRFAX, son of EDWARD FAIRFAX of New-Hall, in the parish of Oteley in Yorkshire, Esq; the famous translator of TASSO's *Godfrey of Bolloign*. He was afterwards sent to Pembroke Hall in the university of Cambridge, where he was entered as a fellow-commoner, and pursued his studies of polite learning with great vigour and success, not without the assistance of Mr. FAIRFAX, as well during his residence in the university, as afterwards in his more advanced years. He took the degree of master of arts at Cambridge, in which he was incorporated at Oxford, in 1640.[z]. After his return from his travels abroad, he lived in the Middle Temple, where he entered into a near communication of friendship and studies with his kinsman EDWARD SHERBURNE, Esq; afterwards knighted, who came thither about the same time from Oxford upon the surrender of it in June, 1646, to the parliament forces. The same year Mr. JOHN HALL of Durham dedicated to him his *poems* published at London, in 8vo. as Mr. STANLEY's own *poems* were in 1651, in 8vo. he having two years before published his translation of and annotations upon the *Europa* of THEOCRITUS, *Cupid Crucified*, and *Venus's Vigils*, to the second edition of which, in 1651, he added a translation of, and notes upon, ANACREON, BION, and JOHANNES SECUNDUS's *Basia*. In the same year 1651, Mr. SHERBURNE dedicated to him his *Salmacis*, *Lyrian*, *Sylvia*, *forsaken Lydia*, *the Rape of Helen*, *a Comment thereon*, *with several other poems and translations*, printed at London, in 8vo. The first volume of Mr. STANLEY's great work, intitled, *The History of Philosophy*, *containing those*, *on whom the Attribute of Wise was conferred*, was printed at London, in 1655, in folio, and the second the year following, the third not being published till 1660. In 1662, his *History of Chaldaic Philosophy* was printed at London; and in 1663, his edition of ÆSCHYLUS at London, in folio, under the title of *Æschili Tragædiæ* vii. *cum scholiis Græcis omnibus*, *deperditorum Dramatum fragmentis*, *Versione & Commentariis Thomæ Stanleii*. He was one of the early members of the Society, being proposed a candidate June 26, 1661, and elected on the 21st of July, as he was again upon the grant of the second charter of April 22, 1663. Besides his works mentioned above, he published several translations, 1. *Aurora Ismenia* and *the Prince*, written by JUAN PFREZ DE MONTALVAN: London, 1650, the second edition. 2. *Oronta*, *the Cyprian Virgin*, by Signor, GI-

[z] WOOD, Fasti Oxon. vol. i. col. 284.

ROLAMO PRETI, London, 1650, 8vo. 3. *A Platonic Discourse of Love*, written in Italian by JOHN PICUS MIRANDULA: printed in 1651, in 8vo. 4. *Sylvia's Park*, by THEOPHILE, *Acanthus Complaint*, by TRISTAN, *Oronta*, by PRETI, *Echo*, by MARINO, *Love's Embassy*, by BOSCAN, *the Solitude*, by GONGORA; all printed with his own poems in 1651, in 8vo.

He married while he was young, DOROTHY, eldest daughter, and one of the coheirs of Sir JAMES ENYON of Flowre in the county of Northampton, Bart. by whom he had the accession of a good estate to his own. He died at his lodgings in Suffolk-street, in the parish of St. Martin's in the Fields in the city of Westminster, April 12, 1678, and was interred in the church there. He left behind him a son of both his names, educated in Pembroke Hall in Cambridge, who, when very young, translated into English CLAUDIUS ÆLIANUS's *Various Histories*.

December 5. Mr. HENSHAW, vice-president, in the chair.

Mr. HOOKE presented to the Society a discourse, which he had lately received from the president, written by Signor MALPIGHI concerning the anatomy of plants, being a farther prosecution of that excellent work of his formerly printed. It was dedicated to the Society, and contained, besides a preface and conclusion, seven several heads or subjects of inquiry. 1. Concerning the vegetation or growth of seeds. 2. Of galls, or the round excrescences growing on an oak. 3. Of the various tumours and excrescencies of plants. 4. Of the hairs, down, and thorns of plants. 5. Of the clasps and the like binding parts of plants. 6. Of those plants, which vegetate upon others. 7. Of the roots of plants. Each of these subjects was illustrated by a great number of schemes atd delineations most curiously drawn with distinction of black and red for the better explanation. After the reading of the dedication, which testified the author's great respect for the Society, it was ordered, that a letter of thanks should be sent by Mr. HOOKE to him; and that Mr. HOOKE should also take care, that the discourse be forthwith printed with all possible correctness; and that a good number of the printed copies be transmitted to the author.

The minutes of the meeting of November 28, being read, gave occasion of discoursing further concerning the productions of our own country as to rich and precious stones. Mr. HOOKE affirmed it possible to make as good agate-cups as any brought from the Indies, out of certain flints and other stones plentiful enough in England: and that there was no difficulty of doing this, except the charge of the diamond-powder to cut them, which yet might, in some measure, be supplied by emery or other powders.

Mr. POVEY hereupon speaking of stones full of a variety of figures, remarked, that he had a considerable number of such stones, which he promised to present to the Society for their repository.

He

He obſerved farther, that he had been attempting to make an urn clay like the the curious porphyry * * of the king; but that it would not bake of that thickneſs without breaking.

Mr. Hooke mentioned, that there was a method of making very thick pieces of earth to be burnt, without breaking or chopping: that Mr. Dwight had made ſome heads of earth as big as the life: that his earth was as hard as porphyry: and that the excellency of China-earth was, that it would endure the greateſt fire without vitrification.

From this diſcourſe of ſtones and earth aroſe one concerning metals and minerals, and particularly about the way of making braſs. Mr. Povey promiſed to bring in the whole method of making braſs, practiſed in the foreſt of Dean, where there were vaſt quantities of lapis calaminaris to be had. Dr. Brown promiſed alſo to communicate his obſervations on that ſubject made by him in Hungary.

Mr. Povey mentioned a ſort of ambergriſe, which had been taken upon Florida, and brought over with a king of that country: that this ambergriſe had not exactly the ſmell or conſiſtence of the true ambergriſe, but ſeemed rather to be ſomewhat more bituminous. He was deſired to bring ſome of it, that it might be ſeen and examined, which he promiſed to do.

He added, that he had a ſort of cotton-cod, which produced a down as fine as any ſilk, though it were but ſhort, and not much larger than that of a thiſtle; of which he promiſed alſo to produce a ſpecimen at ſome meeting of the Society.

Mr. Wheeler remarked, that ſcammony produced ſome ſuch cod and down, and promiſed to bring ſome of it to the Society.

Dr. Brown diſcourſing of Hungary, mentioned, that Mr. Bemde, a member of the Society, had ſeen a vine, in which ſome grains of gold were ſaid to be found growing: which Mr. Bemde was deſired to ſhew to the Society: but he ſaid, that it was a miſtake, that he had any ſuch vine; but that count Walstein had a bracelet of ſuch.

Upon diſcourſing on mercury, it was remarked, that it was brought over in copper-balls.

Mr. Hooke produced part of his new weather-clock, which he had been preparing; and which was to keep an account of all the changes of weather, which ſhould happen, viz. 1. The quarters and points, in which the wind ſhould blow. 2. The ſtrength of the wind in that quarter. 3. The heat and cold of the air. 4. The gravity and levity of the air. 5. The dryneſs and moiſtneſs of the air. 6. The quantity of rain, that ſhould fall. 7. The quantity of ſnow or hail, that ſhall fall in the winter. 8. The times of the ſhining of the ſun. He was deſired to proceed to the finiſhing of this, which, he ſaid, he hoped to do within a month or ſix weeks.

He

He promised also to shew at the next meeting an experiment in the condensing engine, which he had procured to be now mended and fitted for many experiments.

December 12. Mr. HENSHAW, vice-president, in the chair.

Mr. HOOKE produced the condensing engine, which he had caused to be mended and made much more serviceable for trial of several experiments therein, of the effects of condensed air.

An experiment was made to see the effect of condensing the air in a gage or standard, which was suspended within the cavity thereof.

It was desired by the Society, that it might be tried at the next meeting in the engine upon some animal, in order to see how much longer a creature would continue alive in the engine filled with condensed air than when filled with common air.

It was ordered, that the rarifying engine might be put in order for the trial of the same animals in rarified air; to see how much sooner an animal will expire in rarified air than in common air of the same extension.

Mr. POVEY presented to the Society for their library a small stitched book in 4to. containing an history of Chelsea College.

He presented likewise for their repository the claw of a West India spider, very much resembling the claw of a lobster or crab; given him by the lord WILLOUGHBY of Parham as a present remedy against the tooth-ach.

He likewise produced some glass-drops, in order to shew the experiment of their violent bursting and discharging the parts of it upon the breaking of the small end thereof. The small end of one of these was broken by a pair of plyers, and the whole body of the glass flew asunder and dispersed its parts every way with great briskness.

Mr. HOOKE mentioned, that the manner of the breaking of the body might be seen, if the same were dipped two or three times in very clear transparent glew; which, it was desired, might be prepared accordingly against the next meeting for making the experiment.

Mr. HOOKE reported, that he had treated with Mr. MARTYN, the Society's printer, for the well printing Signor MALPIGHI's discourse lately sent to the Society; and that he had desired Mr. MARTYN to print fifty copies extraordinary, to be sent to the author as a present from the Society.

Mr. POVEY moved, that a letter of thanks might be written to Signor MAL-

PIGHI

PIGHI from the Society; and that the ſaid letter, after it ſhould be read and approved by the Society, might be printed with the book.

Upon a diſcourſe about ſome ſorts of the leſſer precious ſtones, as agates, mocha ſtones, onyx's, &c. Mr. POVEY related, that the heliotropium was an excellent ſtone for ſtriking fire inſtead of a flint. Marcaſites were alſo mentioned as a ſort of ſtone, which afforded much fire upon ſtriking; and it was ſuppoſed, that the reaſon was, becauſe thoſe ſtones abound with ſulphur.

But it was farther diſcourſed, that the moſt conſpicuous ſparks, that fly from the ſtriking of a flint againſt a ſteel, were the ſmall parts of the ſteel cut off by the flint, and vitrified by the violent motion of the ſtroke, the ſulphur of the iron readily taking fire. For a proof of which, Mr. HOOKE ſhewed an experiment by throwing the filings of iron through the flame of a candle, which immediately kindled and ſparkled like gun-powder.

Mr. BEMDE related the way of collecting the golden ſands of the river Danube, which was by throwing the ſand with water upon a board laid a little aſlope, and cut with many notches like the teeth of a ſaw, with the teeth turned upwards, and againſt the ſlope: by which means all the particles of gold would lodge themſelves in theſe teeth or notches, whereas the lighter ſand, gravel, and dirt will all waſh away. He ſaid, that he had ſome of the ſaid powder here in England, which he had brought from the Danube; and he promiſed to produce ſome of it at the next meeting.

He remarked, that the people by this means of collecting and waſhing ſand would earn ſix or ſeven ſhillings a-day, though their gain thereby were inconſiderable in compariſon of the value of the gold, which they thus collected; the profit of which intirely belonged to the emperor, or thoſe, who farmed it of him.

Hereupon ſome opinions were mentioned about the original of gold.

Mr. HENSHAW ſaid, that it was an inquiry worth conſideration, whence the ſeveral ſhapes of gold proceeded, viz. that found in the mines, and that waſhed out of the ſand of rivers; ſince they ſeemed to be very different, that found in mines being always found in thin planks imbodied in a hard ſtone; but that in rivers being of a quite different ſhape, like ſand. Hence he conceived it worth inquiry, whether it might not be generated out of the river itſelf.

Mr. HOOKE was of opinion, that the original place of gold lay extremely deep in the earth, as being a body heavier than any other yet known, and conſequently ought to lie lower than any in order: that had it not been for ſome former earthquakes and eruptions, it would have ſtill remained in thoſe inacceſſible receſſes, and ſo have never been known, as in all probability many other ſorts of ſtones, minerals, ores, and metals, which may lie below the ſeat of ſubterraneous fires, may remain concealed and unknown to this day: that by means of ſubterraneous fires, earthquakes, and other vapours, that cauſe thoſe effects, thoſe deeper and

and inner parts of the earth may have been thrown up together with the other effect of the same cause, the very mountain: that that part of it, which is thrown up into the top or body of the mountain, may by the violence of the heat and discharge of the vapours be melted in the raising, and dispersed and broken into a multitude of very small globules, or such like figure, and so be blended and mixed with the earth, sand, &c. of the new eruption: that being thus mixed with the earth of the mountain, the rain falling on the upper part thereof, and descending, washeth down into the rivers those smaller particles of the gold, and so leave them in the bottom of their channels.

Mr. Wheeler produced and presented for the repository a cod of scammony mentioned at the preceding meeting, bearing a kind of down like silk, growing on the end of the seeds like those of dandelion; by which they fly in the air like those, and by the winds are dispersed to a great distance.

Mr. Povey, according to his promise at the last meeting, produced some papers, containing his observations about the method of making brass, which had been formerly tried in England. These papers were read by him, and delivered to Mr. Hooke in order that they might be copied into the Registers of the Society[a].

In these papers were mentioned the proportions of tin and of lead to be mixed with copper, in order to make bells, guns, and pots.

Mr. Povey read likewise another paper of Mr. Elsing concerning some copper manufactures.

Mr. Hooke read a letter from Mr. John Locke, dated at Padua, giving an account of the late total eclipse of the moon observed there by an ingenious acquaintance of his, and offering his best endeavours for the service of the Society in those parts.

Mr. Hooke was desired to return the Society's thanks to Mr. Locke for this letter, and Mr. Henshaw moved, that he might be desired to procure the history of the making of verdigrise with wax, and that of the kermes berry, both as to its growth, manner of gathering, preserving, use either for physic, dying, or the like.

Monf. Ezekiel Spanheim, resident from the elector Palatine, was proposed candidate by Mr. Haak.

December 19. Mr. Henshaw, vice-president, in the chair.

The minutes of the last meeting were read; which gave occasion of discoursing about pearls, and of the places of finding them: whereupon Mr. Bemde related,

[a] No copy of them is inserted in the Registers.

that many pearls were found in a river, which runs into the Danube near Paſſau: that theſe pearls were very good; and that they were found in the very mud of that river, and not in the ſhell of any fiſh: and thence it was ſuppoſed, that they were caſt by ſome fiſh out of their ſtomachs, ſince it had been obſerved by Dr. KING, that the pearl in oiſters is generated in the ſtomach of that fiſh.

There was alſo a farther diſcourſe about the manner of the production of metals in the bowels of mountains. Whereupon Mr. HENSHAW declared it as his opinion, that many metals, as gold, were generated and perfected in the ſuperficial parts, as well as in the body of them. But Mr. HOOKE endeavoured to explain how thoſe bodies might be original bodies belonging to a much lower region of the earth; and that they were not produced or generated a-new, but only by earthquakes and ſubterraneous eruptions thrown up from their more natural place, and by the violence of thoſe fires melted out of the minerals, in which they were there bedded; and that thence they came to be diſpoſed and ſcattered into ſmall grains and duſt, and found intermixed with very heterogeneous bodies.

Upon tne mention of Mr. LOCKE's letter, Sir JOHN HOSKYNS gave an account of the manner of making verdigriſe with the huſks of grapes, after the expreſſion of their juice, and ſmall plates of copper thrown and buried amongſt them.

Sir JOHN HOSKYNS preſented to the Society for their repoſitory a branch of white coral, which he received from Mr. GORING BALL. It was ſingular in this, that the ends of the branchings were terminated with a kind of pearl, the ends being hollowed like a cup with ſix ſmall ribs within, each of which ended in a ſmall knob or pearl; and between each of theſe was orderly placed another ſmall knob, amounting to twelve in all.

Mr. BEMDE produced ſome of the ſand mentioned by him at the laſt meeting to have been taken up in the Danube; which was ſome of that, out of which the people ſeparated the golden duſt by waſhing. Some of it was delivered to Mr. HUNT for the repoſitory.

Mr. BEMDE preſented likewiſe a black ſtony ſubſtance, intermixed with a curious green, which he had taken up on the mountain Veſuvius. It had the appearance of a black and green glaſs; and thereupon it was tried with a coal, and the flame of a candle caſt on it with a ſoddering pipe, in order to ſee, whether it would melt; but upon trial it was found not to melt, but to be a real ſtone.

Mr. COLLINS preſented from Mr. MARTINDALE a propoſition or diſcourſe of compound intereſt or annuities, contained in three leaves of paper in 4to. to be printed, if the Society ſhould think proper, with ſome other papers.

Mr. ENT produced a root of barley, out of which grew thirty ſtalks, on each of which was an ear of barley.

Sir JOHN HOSKYNS produced some of the powder taken out of Dulwich well-water.

The experiments exhibited were in order to shew the use of air for the sustentation of the life of an animal: upon which subject the query was, whether the same animal would continue to subsist in an inclosed air for a time proportionable to the quantity of air contained in the vessel? Whether the said air were free and under no extraordinary compression or dilatation? Or whether it was either compressed or dilated by the force of the engines made for that purpose. In prosecution of this inquiry there were several birds provided, one of which was inclosed in a glass vessel with common air: a second in a receiver, out of which the air was afterwards exhausted; and a third was to be inclosed in the condensing engine, into which double the quantity of air was to be forced. The event was, that the bird in the exhausting engine presently died; but the other in the common air continued in the receiver till the Society rose, without any sensible alteration: whence it was judged, that it would live a considerable time longer before it was stifled.

December 26. At a meeting of the COUNCIL were present

Mr. HENSHAW, vice-president, in the chair.

Sir JOHN HOSKYNS,	Mr. ALLEN,
Dr. GALE,	Dr. BROWN,
Mr. HILL,	Dr. GREW,
Mr. COLWALL,	Mr. HOOKE.

It was ordered, that the treasurer repay Mr. HOOKE the five pounds paid by him to Mr. CRAWLEY for workmanship about the weather-clock; as also his salary for half a year ending at Christmas, voted by ballot.

Dr. GREW was put in mind to procure the Museums for the library of the Society, according to the desire and direction of the president.

It was ordered, that the treasurer give to Dr. GREW ten pounds as a gratuity for his service to the Society as secretary, voted by ballot:

That the treasurer pay Mr. WICKS one year's salary ending at Christmas, 1677, voted by ballot:

That Dr. GREW have liberty to borrow such of the natural rarities in the repository, as he shall have occasion to describe; and that he leave a catalogue of the same with Mr. HUNT, till he return them; which is to be within one week: voted by ballot: And

That Mr. HOOKE be desired for the future to keep the correspondence of the Society; and that the same shall be continued by the help of a small Journal of some particulars read in the Society: that the said Journals shall not be sent or sold

ſold to any perſon but members of the Society, and to ſuch as correſpond with Mr. Hooke by the Society's directions, and make conſiderable returns to him for the Society's uſe; all which returns ſhall be conſtantly brought into the Society, and read before them at the very next meeting after the receit thereof. And Mr. Hooke was deſired to draw up a ſpecimen of the ſaid Journal propounded by him againſt the next meeting of the council: voted by ballot.

A paper brought in by Dr. Gale, containing rules for the keeping of the library, was read and approved; as follows:

" Orders concerning the government of the *Bibliotheca Norfolciana.*

" 1. That the long gallery in Greſham College be the place for the library, if " it may be procured.

" 2. That an inſcription in letters of gold be ſet up in ſome convenient place " in honour of the benefactor.

" 3. That there be an exact catalogue of all the books of the *Bibliotheca Nor-* " *folciana* made apart, and alſo of all other books, which ſhall accrue.

" 4. That for ſecuring the books, and to hinder their being embezzled, no book " ſhall be lent out of the library to any perſon whatſoever.

" 5. That ſuch perſon or perſons, as ſhall deſire to uſe any book in the library, ſhall return it into the hands of the library-keeper entire and unhurt.

" 6. That the library ſhall be ſurveyed once in the year by a committee choſen by the council to the number of ſix, any three of which to be a *quorum.*"

It was ordered, that Mr. Hooke do agree with Mr. Bradell about two rooms, which he deſires of Dr. Pope's lodgings; but that he do not let them under five pounds *per annum.*

$167\frac{8}{9}$, *January* 2. Sir Christopher Wren, vice-preſident, in the chair.

Dr. Grew read a letter in Latin to himſelf from Christian Mentzelius, counſellor and archiater to the elector of Brandenburg, dated at Berlin, 31ſt July, 1678[b], expreſſing his kind acceptance of the offer, which had been made him of holding correſpondence with the ſecretary of the Society, and his deſire of continuing it, as he had formerly begun it with Mr. Oldenburg; and more eſpecially concerning ſuch inquiries, as he had with great delight been much employed in, the nature, qualities, and ſpecies of vegetables. In the poſtſcript of this letter he makes mention of the eighth year of the Ephemerides *Naturæ Curioſorum* at Breſlaw, wherein was inſerted a tranſlation of Dr. Grew's *Anatomy of Vegetables:* and that

[b] Letter-book, vol. viii. p. 56.

JACOBUS BREYNIUS of Dantzick had that year published *Centuria Plantarum rariorum, præsertim ex promontorio Capitis Bonæ Spei desumptarum, cum figuris æneis summa arte ad vivum incisis*, in folio.

Dr. GREW read likewise a letter to himself from E. LEICHNER, dated at Erfurt, 15th November, 1678 [c], containing an inquiry after some things, which he had formerly sent, and received no answer about; and also a printed half sheet, intitled, *D. E. Leichneri excerpta Diatyposis tractatûs de Physico-Medica Analysi, in duos distincti libros:* by which he hoped, that natural philosophy and physic might obtain its utmost felicity.

The minutes of the last meeting of December 19. being read, on the mention of the barley, that produced such great increase, Mr. HENSHAW remarked, that there was a *triticum multiplex* first brought from Persia, which would yield two thousand for one. This was seconded by Sir JOHN HOSKYNS, who observed, that it would do the same in any other plant, he having found it upon trial to succeed. He added, that the stalk of it was not hollow like other wheat, but solid; and that it was much preyed on by birds.

Upon the mention of pearls, Mr. HENSHAW observed, that they were often found in fresh-water as well as in salt, viz. in a sort of horse-muscles found in rivers.

Upon a discourse about sand gold, Sir CHRISTOPHER WREN remarked, that the figure thereof for the most part was shaped like * * or salts of regular flat sides and angles; and that it was seldom found like small particles of a melted metal: that he had seen bags of these sands, the most part of which were thus shaped, and yet very pure gold.

Dr. PLOT, upon the discourse of barley, made mention of a certain sort of barley called Patney barley, from a place of that name in Wiltshire. This barley, he conceived, would be of great use in cold countries, by reason that it will be thoroughly ripe in nine or ten weeks from the time of its sowing; and consequently come within the limits of the shortest summer. Of this he had given an account in his *Natural History of Oxfordshire.* By others it was called rare ripe barley.

Mr. HOOKE gave an account of the experiments, that had been shewn at the last meeting, and the design of them, and of the time and manner requisite for the completing such experiments: and he desired, that there might be a committee appointed for the making such trials, as could not be made within the time of the sitting of the Society, since many experiments could not be made within so short a space.

Dr. PLOT left with the Society a printed sheet of his inquiries, made in order

[c] Letter-book, vol. viii. p. 66.

to the writing of the natural hiftory of all parts of England. This he did with a defire, that it might be perufed by the members, and fuch alterations made therein, as they fhould fee reafonable.

Mr. Hooke fhewed an experiment with gun-powder, in order to examine whether the burning thereof confumes or produces more air. And upon trial thereof it was found, that [d]

January 9. The prefident, with Sir John Lowther, Mr. Henshaw, Mr. Thynne, and feveral others, went up into Mr. Hooke's turret, to fee the farther progrefs, which had been made in the clock contrived by Mr. Hooke for keeping an account of the feveral variations of the weather; which was well approved of by them.

The prefident took the chair.

The minutes of the laft meeting of January 2. were read; whereupon mention was made by the prefident of continuing and promoting correfpondence with foreign parts; and it was defired, that the propofal made by Mr. Hooke fhould be farther confidered of by the council, in order to the promoting of that defign.

Upon the mention of gold-powder, &c. Mr. Henshaw farther obferved, that all gold, that was not found in rivers, was found imbodied in very hard ftones, and fo feemed to be generated in them. And that fuch, as was found in rivers, was for the moft part found in fuch parts of them, where they made any confiderable bend or turning or eddy.

The queftion concerning the figure of duft or fand-gold was farther debated; and it remaining yet a doubt, whether it was found fo figured, as had been fuppofed of regular figures, it was defired, that Mr. Hooke fhould endeavour to get a fight of fome duft gold, and examine the fame with care, to fee and defcribe the moft ufual figures thereof.

On a difcourfe concerning the mineral of copper, Sir John Lowther related, that there was a fort of mineral found in Cumberland, which feemed to be a very rich copper ore; but that having fent the fame to be tried at London, it was found to burn and flame all away like brimftone, and to yield no copper at all.

Mr. Hooke remarked, that this might probably happen from the mixture and union of fome falts and fulphurs with the metal; and that if they were not by fome other artifice feparated from the metal before the fame come to be tried by the violence of the fire, without fuch artifice or mixture, the fulphur and falts would carry away the metal of the copper, and never fuffer it to melt or feparate from them into a body. For confirmation of this he alledged, that he knew a way to make even the body of common copper commix again with fuch heterogene-

[d] This minute was not completed.

ous

ous bodies, and being put into a fire to fly all away, and burn almoſt like common brimſtone; which copper ſo ordered might yet be again reduced ſo as to melt, and not fly away at all.

Mr. HENSHAW related a way of making a brimſtone out of copper.

Sir JOHN LOWTHER gave a deſcription of the copper-mines.

Mr. HOOKE gave an account of the deſign of the experiment about reſpiration, and moved, that there might be a committee appointed of the phyſicians and ſuch other members of the Society, as deſired to be farther ſatisfied concerning that inquiry, in order to make that experiment on ſome other day than that of the meeting of the Society, ſince that experiment could not be tried within the time of meeting: and he propoſed it as a very deſirable thing for the promoting the ends of the Society, that the committee formerly appointed for the trial and examination of ſeveral matters might be revived.

Hereupon a committee was appointed to make trial of this experiment of reſpiration, conſiſting of Dr. CROUNE, Dr. MAPLETOFT, Dr. ALLEN, Mr. HILL, and ſuch others of the Society, as ſhould deſire to be preſent at it.

Upon this a diſcourſe aroſe about reſpiration.

Dr. CROUNE was of opinion, that the ſteams from the breath and body were the occaſion of the death of ſuch animals, as were incloſed in a veſſel. Mr. HOOKE objected, that if this were ſo, then an animal included in condenſed air would be ſtifled by thoſe ſteams ſooner than one included in a veſſel, out of which a part of the air was exhauſted; whereas the quite contrary appeared by experiment. He added, that he rather conceived it to proceed from the ſatiating of the diſſolving part of the air, and ſo making the remaining part effete and uſeleſs for maintaining the life of animals, which ſeemed to have much the ſame nature with flame and fire, ſince the ſame effects ſeemed to happen to it. Hereupon Mr. HENSHAW mentioned the experiment, that had been formerly given to the Society; which the preſident deſired be again ſhewn at the next meeting,

January 16. The preſident in the chair.

The minutes of the laſt meeting being read, the preſident took occaſion to propound it as a matter deſirable, that an account ſhould be procured of the obſervations made of the quarters of the wind in the ſeveral parts of the kingdom; of which the letters from ſeveral parts gave an account.

He alſo inquired, whether Dr. GOAD [c] had perfected his theory of predicting the quarter and ſtrength of the winds from aſtronomy. To which Sir JONAS MOORE anſwered, that Mr. FLAMSTEAD had examined ſeveral of Dr. GOAD's

[c] JOHN GOAD, M. A. maſter of Merchant-Taylors ſchool in London. His *Aſtrometeorologia* was publiſhed in 1686.

predictions,

predictions, but had not found one of them true. But Mr. Henshaw had examined them continually for about two years about a month since, and had found not above one of four false.

The president then inquired, why the Society did not receive some account from Mr. Flamstead: to which Sir Jonas Moore answered, that he would within a fortnight be ready to produce a book of his observations.

It was likewise inquired what was become of the instruments of the Society, that had been carried to Greenwich; and it was desired, that they might be returned to the repository, in order that they might be ready for the use of the Society.

The president inquired of Sir Jonas Moore concerning an experiment, which he had been informed of, viz. of the throwing a copper farthing into a liquor, which being * * would prove good gold [d].

Mr. Henshaw supposed, that it might be done somewhat after the manner of precipitating silver out of Æ. upon copper-plates.

Mr. Hooke mentioned another experiment somewhat like it, whereby iron was said to be turned into copper: and Mr. Henshaw mentioned the chains said to be turned from iron into copper by the mineral waters in Hungary brought from thence by Dr. Brown.

Mr. Evelyn related, that salt of silver being dissolved in water might by mercury put into that water, then evaporating it, and expelling the sediment, be reduced to silver again.

Hereupon Mr. Henshaw related, that the duke of Buckingham had a method of making mercury, which would grow hot by dissolving gold. Dr. Croune added, that Mr. Boyle had done the same thing; but had said, that the experiment of making this mercury did not always succeed.

Mr. Henshaw related a like experiment of augmenting gold made by Dr. Kuffler [e], which was made by an aquafortis made by the help of sand taken out of the ballast of a ship; which experiment being tried with other sand he found not to succeed.

Mr. Henshaw farther gave an account of the manner, how Dr. Kuffler hatched chickens by the help of furnaces, the process of which he had seen; which was, that the doctor had a wire-grate placed over a balneum at a foot distance with a cover over, pulled up by a pulley; in which grate he set the eggs, and so turned them every day for eighteen days together: then he laid

[d] Sir Jonas Moore's answer to this question is not inserted in the Journal, vol. vi. p. 151.

[e] In the minutes it is by mistake *Kepler*.

them on a hair-cloth in a ſtove near the aſh-hole, where they hatched themſelves with their own bills; in which ſtove he kept them for three days, till they could feed themſelves, which was when the yolk was conſumed in their bellies. He added, that in Egypt they do this with camels dung.

Sir JONAS MOORE remarked, that Sir CHRISTOPHER HEYDON together with DREBELL long ſince in the Minories hatched ſeveral hundred eggs; but mentioned not the way; but that it had this effect, that moſt of the chickens produced that way were lame and defective in ſome part or other.

He added, that DREBELL had an art, by which he could produce a fly in an hour's time any where.

Dr. CROUNE related his own obſervations made with the eggs of a pullet, which, he was aſſured, had never been trod by a cock, and yet laid five or ſix eggs in a week. This he was aſſured of, as having kept the pullet in a coop from the time it was hatched, and never ſuffered any cock to come near her. Theſe eggs being ſet under a hen proved addle and effete; but being examined by him before they were ſitten upon, he found the cicatricula as in other eggs, and the body of a chicken formed in the cicatricula. Hereupon the doctor was deſired to proſecute this experiment yet farther, and to examine the cicatricula with a microſcope, and to ſhew it to the Society.

Sir JOHN LOWTHER promiſed to procure ſome of the copperas ore, in order to its being examined by Mr. HOOKE.

He deſired to be informed of the nature of the Swediſh * * and what quantity of copper it contained, and how it was ſmelted.

Sir JOHN HOSKYNS remarked, that GLAUBER had ſhewn the way how to extract a metal out of the pyrites.

Upon a diſcourſe concerning the ways of making ſalt, Mr. HOOKE related, that he had been newly informed by a doctor, who had lived in Ireland, that he had ſalt-works in the north-weſt parts of Ireland, where he boiled up the ſea-water into ſalt in iron-pans by the help of turf or peat to great profit or advantage.

Sir JONAS MOORE obſerved concerning peat-pits dug in the fens, that they will in a ſhort time fill again with good peat fit to be dug.

Sir JOHN HOSKYNS related, that he had obſerved the ſame thing in Bedfordſhire.

Sir JONAS MOORE mentioned, that there was at the top of Pendle-hill in Lancaſhire a plain about a quarter of a mile over, which being dug to the depth of about five or ſix feet, is found to contain great numbers of foſſile-trees, ſuppoſed to be fir.

He

He added, that this hill was a great receptacle of waters; and that there had had been ſeveral times obſerved great guſhings out of water from the ſides of it; which had happened at ſeveral times at the diſtance of about thirty years.

At the top of this hill grows the cloud-berry no where elſe found.

Dr. CROUNE mentioned ſome ſuch kind of obſervation of the ſprings about Epſom, which once in about ſeven years were obſerved to riſe and overflow the grounds and cellars thereabouts.

Mr. EVELYN upon this occaſion mentioned an inſtance of a hill, that was hollow underneath, and ſo muſt have a great receptacle of water; the river Mole ſinking under it on one ſide, and riſing out again on the other. This was Box-hill near Darking in Surrey, under which the Mole paſſes.

Mr. HENSHAW obſerved, that the river Guadiana in Spain is much of the ſame nature.

Mr. HOOKE ſhewed the experiment of putting fire into a tin box, and there keeping it blowed on with bellows, till it appears to have quite loſt its burning and ſhining: then admitting freſh air into the ſame, and blowing it with the ſame bellows, it preſently rekindled and burned and ſhined as before. This was thrice repeated to the ſatisfaction of the members preſent. But that ſome farther proof of his theory might be examined, he was deſired to ſhew ſome other experiment of this nature at the next meeting.

Dr. CROUNE read a letter of his to BORELLI, to invite him to ſend over his diſcourſe *De motu animalium*, ſince the Society would endeavour to procure it to be well printed here. The doctor was thanked by the Society for this letter, and deſired to ſend it as ſoon as poſſible.

Mr. HOOKE ſhewed a ſecond experiment, which was the flame of a candle ſo placed between the eye and a concave metalline ſpeculum, that the air, which incompaſſed the ſaid flame, by diſſolving the parts of it into itſelf, became of a different nature and different refraction from that, which was not ſatiated by the ſaid diſſolution.

This was plainly ſeen by the preſident and divers others of the members preſent to their ſatisfaction.

January 23. At a meeting of the COUNCIL were preſent,

Sir JONAS MOORE,	Dr. MAPLETOFT,
Sir JOHN HOSKYNS,	Dr. CROUNE,
Mr. HILL,	Mr. HAAK,
Dr. GALE,	Mr. CREED.

It was ordered, that Mr. Hill do take care to collect the arrears due from the priory of Lewes, and employ whom he shall think fit for the collecting thereof: And,

That the paper brought in by Sir John Hoskyns, and here perused and amended, be forthwith fairly ingrossed in parchment, and the instrument sealed and carried to the president.

At a meeting of the Society on the same day, the president in the chair.

The minutes of the last meeting being read gave occasion to inquire farther of Sir Jonas Moore concerning Mr. Flamstead's observations: to which he answered, that a quantity of them were ready for the press; but the booksellers were unwilling to undertake the printing of them: whereupon Mr. Hooke was desired to speak with Mr. Martyn [f] concerning it.

Sir Jonas Moore likewise gave farther account, that Mr. Flamstead and Mr. Halley had newly made some observations in order to find out the parallax of Mars now achronical and retrogade; and that he had found from examining the observations by calculation, that the parallax of the sun would not be more than 30′ nor less than 11′; which he conceived was much nearer than any person had hitherto certainly observed it.

Upon the mentioning the turning copper into gold by a liquor, Mr. Povey related, that Sir Thomas Williams had told him, that he had cut a copper farthing in two, and throwing into the liquor, it was dissolved by it; and that upon evaporating the liquor, and expelling the remainder, he had found the same weight of the farthing in good gold. He added, that Mr. Slingesby supposed it to arise from the copper's precipitating the gold, that had been formerly taken up by the liquor.

The president related, that his majesty had lately received a letter from Vienna, wherein were inclosed some curiosities relating to the way of making gold, conveyed by Mr. Schroter.

Upon an occasional discourse about teeth Mr. Henshaw mentioned a relation, which he had met with, of artificially setting in new teeth in the place of old ones plucked out; adding, that it was observed, that if the new ones were presently inserted, as soon as the old ones were drawn out of the jaw bone, the gums would coalesce and inclose the teeth as firmly almost, as if they were the natural. He added, that one Monf. du Pont upon drawing out a wrong tooth, and finding his mistake, had presently clapt it into its place, and closed the gum, which thereupon remained as fixed, as if it had not been drawn.

He gave also a relation of a young lady, whose teeth being much rotted by

[f] The Society's printer.

eating

eating ſweet meats, were drawn out, and the teeth of a young boy being ſet in their place had fixed there, and grown very well. This was done by Mr. Gosling here.

Upon a farther query concerning chickens produced by ſtoves, whether they would be fruitful and produce eggs and chickens as others, that were hatched the natural way, Mr. Henshaw affirmed, that they were abſolutely as fruitful in thoſe reſpects as the others.

Hereupon was occaſioned a diſcourſe about ſpontaneous generation. Mr. Hooke related, that he had been informed by Mr. Wylde, that he could order earth ſo, as that without ſetting or putting any peaſe at all into it, it ſhould produce peaſe: as alſo that the ſame Mr. Wylde had told him, that Monſ. le Febure, the king's chemiſt, had aſſured him, that he having thrown out on a dunghill a pretty large quantity of the caput mortuum of fennel ſeeds, from which he had extracted the oil by diſtillation, had obſerved the following year, that the whole dunghill was overgrown with young fennel, as if it had been ſowed with fennel-ſeeds: concerning which it was conjectured, that the ſweepings of the laboratory, which were thrown to the ſame place, were more probably the cauſe of this great fruitfulneſs.

Upon a diſcourſe about the ſtrength of ſalt, it was conceived, that ſea-ſalt was much ſtronger than ſalt made by boiling, by reaſon that the extraordinary heat of the fire makes a conſiderable part of the ſalt riſe in fumes; whereas the natural heat of the ſun on that, which is made abroad, is not powerful enough to produce the like effect.

Sir John Lowther added, that ſpring waters are much ſtronger than the ſea-water; ſo that they commonly yield a fourteenth part of ſalt, ſometimes an eighth; whereas ſea-water yields not above a two and fortieth part. He farther obſerved, that the lord Lumley's ſalt was accounted the beſt.

There was likewiſe a diſcourſe about making ſalt-water freſh by filtration; and the opinion was, that no filtration through ſand, earth, or the like, would make ſalt-water freſh.

Sir John Lowther mentioned, that at the * * they ſaved the draining of the ſalt, and found, that that would very much contribute to the making of more ſalt by putting it to the brine, that was to be boiled: but on the other hand thoſe, who made ſalt out of ſea-water, uſually threw it away, as ſuppoſing, that it hindered the producing ſalt in the next boiling.

Mr. Hooke obſerved, that the draining of ſalt from ſea-water was uſually very bitter and red, and was for the moſt part thrown away; only ſome of it was uſed for the waſhing the ſores of ſheep and cattle, as being a great drier: and he farther conceived, that it was made by a diſſolution of the iron-boiler, and therefore might be of another nature.

Mr. POVEY obſerved, that Sir ROBERT HOWARD had acquainted him, that in his part of a ſalt-work there was a ſubterraneous ſalt-river.

Mr. HOOKE ſhewed his experiments; the firſt of which was the ſetting a chafing-diſh of coals into the box, and ſuffering it to ſtay there till it went out, and ceaſed to ſhine: then by a hole at the top letting down into the air of the box a wax-candle, it would preſently be extinguiſhed, as if it were dipt in water; and that as ſoon as ever the air came to touch the flame of the candle. But that air being changed, and freſh air admitted into the box, the coals began to ſhine afreſh, and the candle let down into the box continued to burn and ſhine as in the open air.

His ſecond experiment was by putting in a box filled with lighted coals burning clear, when the air had been ſatiated, as abovementioned, by the coals, which had been ſet into it: which coals preſently ceaſed to burn, and looked as if they had been quite extinct; which very coals, as ſoon as ever the freſh air was admitted, preſently began to ſhine and burn as before.

The experiments for the next meeting were to proſecute this theory of Mr. HOOKE, that air is a menſtruum, that diſſolves all ſulphureous bodies by burning, and that without air no ſuch diſſolution would follow, though the heat applied were as great.

January 30. Being the anniverſary faſt for the death of king CHARLES I. the Society did not meet.

February 6. The preſident in the chair.

This meeting began with a diſcourſe about the barometer and preſſure of the atmoſphere, concerning which it was debated, what might be the reaſon, why the air ſhould preſs leſs in rainy than in dry weather. Mr. HOOKE ſuppoſed, that it might proceed from this, that the air at ſuch time, as it is heavy, takes up more of the heavy parts of other bodies, and keeps them ſuſpended; whereas in moiſt and ſtormy weather the air being of another nature could not be charged with ſuch vapours.

There was alſo a diſcourſe about what was fit to be publiſhed of the *Tranſactions* of the Society [g], and in what manner; but the determination of that matter was referred to the council.

The minutes of the meeting of 23 January were read; whereupon there were ſome other things added about drawing out and ſetting in teeth artificially.

[g] They had been diſcontinued from June, 1677, n° 136, upon Mr. OLDENBURG's death, till January $167\frac{7}{8}$, when Dr. GREW reſumed the publication of them, and continued it from n° 137 to n° 142, for the months of December 1678 and January and February $167\frac{8}{9}$: after which they were intermitted till January $168\frac{2}{3}$.

Sir John Hoskyns cited Malpighi for aſſerting, that teeth continually grow; that they have ſeveral coats or ſhells like teſtaceous ſubſtances; and that the outward coats wear off and wear out with uſing.

Mr. Henshaw mentioned Monſ. du Pont's papers, which were in the hands of Mr. Evelyn, about the way of ſetting in new teeth artificially. He remarked, that ſea-horſe teeth afforded the beſt ſubſtance to make artificial teeth of: that theſe artificial teeth will ſtink in a little time, if they be not taken out of the gums and cleanſed: that they would alſo in time grow yellow and black: that the hard coat of teeth by rubbing will be worn out: and that thereupon the reſt of the tooth ſuddenly decays.

About the nouriſhing of teeth Mr. Arderne quoted * * opinion, that they are nouriſhed by the *ſuccus nutritius* from the nerve.

Upon reviving the diſcourſe about making ſea water freſh by filtration and diſtillation, it was generally concluded, that the freſh water of ſprings proceeds either from the rain, dew, or condenſation of the moiſt air on the tops of hills.

Monſ. Spanheim was elected.

Thomas Sheridan, Eſq; was alſo elected.

Sir William Waller was propoſed candidate by the preſident and the earl of Ayleſbury.

Mr. Hooke ſhewed two experiments in order to illuſtrate his theory about fire.

The firſt was the letting down a lighted wax candle into a glaſs of air, which about ten days before had been ſatiated by a veſſel of live coals put into it, and ſuffered to remain till they were quite extinct: at which time the veſſel was cloſely ſtopped up, and had been kept ſo ever ſince. The effect of which was, that the candle put into it continued to burn a conſiderable time, as if it had been freſh air. It was conjectured, that upon the condenſation of the air upon cooling after the coals were gone out, the freſh air had made its way into the glaſs, and ſo refreſhed the air, and made it fit for burning. Others ſuppoſed, that the air might have recovered its former nitrous quality by letting fall thoſe parts of the coals, which it had formerly diſſolved. It was deſired, that this ſhould be farther and more carefully proſecuted.

The ſecond experiment was to ſhew, that a coal, though kept in a very great heat, would not be conſumed or burnt, unleſs there were an acceſs of freſh air. There was a charcoal included in a cylinder of glaſs, and ſo perfectly ſealed up hermetically: then this glaſs was put into a chafing diſh of live coals, and ſuffered to lie there a conſiderable time in a heat great enough to melt the glaſs, ſo that the glaſs ſhaped itſelf into the form of the coal: notwithſtanding which the coal remained unconſumed, and manifeſted the neceſſity of air for making an actual fire.

The

The experiments for the next meeting were to be such, as should farther demonstrate the former theory.

February 13. Mr. HENSAAW, vice-president, in the chair.

Upon reading the minutes of the last meeting the Society again entered upon the debate concerning the causes and reason of the motion of the mercury in the barometer: and it was conceived, that it proceeded from the gravitation of the air, which at some times pressed more and at other times less. This variety of pressure was conceived to proceed from two causes; the one, that the air at such time, as the quicksilver rose higher, had a new accession of air at the top thereof, which caused it to have a greater hight, and consequently a greater pressure. And the other was, that there were new accessions to the air from the earth, which made the same hight of air have different gravitation, and consequently different pressure; the former being explained by a cylinder of the air of the greater altitude, whose parts continued of the same gravitation; the other by a cylinder of the air of the same or possibly less altitude, but the parts thereof of greater gravity and more dense. This was farther explained by shewing, that the heat and cold working upon the same quantity of the air, though it would make the same cylinder of a greater and a less altitude, according as the heat expanded it, and the cold contracted it; yet would not at all alter the pressure thereof, there being in both the same quantity of gravitating parts.

Mr. HENSHAW moved, that the substance of this discourse might be drawn up; and that the whole theory might be fully explained, as soon as possible; the barometer being become an instrument of general use, and the causes and reasons thereof very commonly debated amongst the learned.

Sir JONAS MOORE observed, that the barometer at Tangier had for near a year very little alteration, but continued always much about the same hight.

Previous to the experiment there was much discourse upon those of the last meeting concerning the cause of fire, and it was generally concluded, that the said experiments farther explained and illustrated the theory of fire by the air's consuming, dissolving, or corroding the burning body.

Mr. SHERIDAN was admitted; as was also Mr. FLAMSTEAD, who had been formerly elected [h].

Mr. HOOKE shewed an experiment, which he had mentioned at the last meeting; the design of which was to see, whether a coal heated to a degree sufficient to melt the glass, that included it, would by that violence of heat be consumed or made to shine and give light. To this end a piece of charcoal was included in a urinal glass so ordered by the means of wires, that the charcoal remained in the middle of the belly of the urinal without touching either the sides or bottom.

h February 8, 167$\frac{6}{7}$.

Then

Then this urinal was placed upon a chafing-diſh of clear burning coals, and ſo ſuffered to ſtand till the belly of the glaſs was red hot; at which time the mouth of the urinal was cloſe ſtopped with clay. Then the coals in the chafing-diſh were blowed upon very quick with bellows, whereby the lower parts of the urinal melted, and were thruſt inwards by the coals, on which it ſtood: notwithſtanding which great heat the coal in the middle of the glaſs did not burn or ſhine, or at all ſeem to conſume, till by taking off the clay, that ſtopped the mouth, and blowing in freſh air with the bellows into the body of the glaſs, the ſhining, burning, and diſſolution of the coal plainly appeared: and that coal, which before in a much greater heat had remained black, as if cold, now in a much leſs heat grew all over red, lighted, and preſently after the white aſhes covered its ſurface: which was judged an evident ſign, that the heat of a fire, though exceedingly hot, was not able to burn a combuſtible body without air; and that the air was the body, that wrought the effect upon the combuſtible body.

Mr. George Ent preſented to the Society for their library a book newly publiſhed by his father Sir George Ent, in anſwer to a diſcourſe of Dr. Thruston about reſpiration [i].

February 20. Mr. Henshaw, vice-preſident, in the chair.

The minutes of the laſt meeting of the 13th being read gave occaſion to diſcourſe farther concerning the theory of the barometer, from what cauſes the alteration thereof might proceed.

Some were of opinion, that the cauſe thereof might proceed from the extraordinary hight of the air only ebbing and flowing as it were like a tide, but with unconſtant motions.

Mr. Hooke was of opinion, that to this was to be joined the particular and ſpecific gravity of the body of the air, as being charged ſometimes with heavier, ſometimes with lighter vapours or bodies diſſolved into it, or taken up by it. He farther explained how different hights might produce the ſame preſſure, provided there were the ſame quantity of gravitating within the ſame cylinder: and he inſtanced, that a cylinder of the ſame air rarified into greater hight in ſummer could have no more preſſure, than when in the winter time it is condenſed into a much ſhorter. Farther to elucidate his theory of it he added, that he would at the next meeting produce ſome experiments.

Sir Jonas Moore acquainted the Society, that he had by him ſome papers of Mr. Townley's obſervations on that ſubject; as alſo ſome late obſervations of Mr. Flamstead; and that he would produce them at the next meeting.

It was deſired, that the experiments formerly propounded by Mr. Hooke to be

[i] Dr. George Ent's book was printed at London in 8vo. under the title of ΑΝΤΙΔΙΑΤΡΙΒΗ, *ſive Animadverſiones in Malachiæ Thruſtoni, M. D. Diatribam de Reſpirationi uſu primaris.*

be tried at the column on Fish-street-hill might be anew prepared: and in order thereunto Mr. Hooke was desired to provide convenient glasses and other conveniencies for the perfecting that trial: and that then the trial might be made again with all the care and exactness necessary.

Hereupon it was queried, how this experiment of the different pressure of the atmosphere came first to be thought of; and it was related, that it was first propounded by Sir Christopher Wren, in order to examine Monf. des Cartes's hypothesis, whether the passing by of the body of the moon presses upon the air, and consequently also upon the body of the water: and that the first trial thereof was made at Mr. Boyle's chamber in Oxford.

Mr. Henshaw desired, that Mr. Hooke would again shew this experiment, which he had formerly produced, in order to explain his hypothesis of the reason of the alteration of the pressure of the atmosphere.

Dr. Grew desired, that the hypothesis, which he had formerly produced to the Society, might be considered of; for that he conceived that alone to be sufficient to explain the whole theory. The substance of it was, that the pressure of the air proceeds from the salts, that are dissolved into the air: that these salts, when they are dissolved, take less room; and so the air becomes less pent and crowded together, and consequently presses less: but when the salts are undissolved, they take more room, and so croud the air more, and make it press more upon the stagnant quicksilver.

Dr. Croune explained also his hypothesis of this phænomenon, which was to this effect [k]:

It was thought very desirable, that queries should be made concerning the different gravitation and pressure of the atmosphere in several parts of the earth, that by the comparing these together the theory might be thereby compleated.

Mr. Halley affirmed, that he had made observations of the hight of the mercury in the barometer at St. Helena; and that he had found the hight thereof but twenty-seven inches at the top of the hill, when it was twenty-nine inches at the bottom near the water-side.

Mr. Edward Tyson [l] was proposed candidate by Mr. Hooke, as being very curious in anatomy, and one who would be very useful to the Society in producing observations of that kind.

Upon reading the account of the experiments shewn at the last meeting for explaining the hypothesis of fire, and particularly that of the saltpetre, Sir Jonas Moore was very desirous to know by what means he might certainly find what quantity of saltpetre any gunpowder, which he was to examine, contained.

[k] This minute is left thus imperfect.

[l] He was then M. A. and afterwards M. D.

And

And he received for anſwer, that he might eaſily be reſolved in that inquiry, if he took a certain quantity of the powder, which he deſigned to examine, and ſteeped it in ſo much water, as would diſſolve all the ſaltpetre contained in the powder; then filtred the water through cap-paper, and gently evaporated the ſolution in a broad glaſs veſſel; for by the remaining ſalt after evaporation he would eaſily know what quantity of it each pound or barrel of gun-powder contained.

He remarked, that there was great difference in the goodneſs of ſeveral ſaltpetres: that the Dutch petre would waſte but four pounds in the hundred; but that Engliſh petre would waſte eighteen.

Sir William Waller was unanimouſly elected.

Mr. Hooke produced two experiments in order to make his theory of fire more evident.

The firſt was a charcoal weighing an hundred and twenty-eight grains put into a box of iron with ſand enough to fill the cavity of the box not filled by the charcoal, and therein ſcrewed up very cloſe by an iron ſcrew-pin. Then it was put into the fire, and there for the ſpace of two hours kept very hot, viz. of a bright red hot. After which the iron was taken out of the fire and ſuffered to cool; then opened; and the coal being taken out and weighed, was found to have loſt but a grain and half of its weight; which was attributed to the moiſture, that might be in the ſaid coal when put in. It was farther remarkable, that the ſhape of the out-ſide of the coal was not altered, nor any way conſumed.

The ſecond experiment was the ſetting of a crucible full of nitre in a very hot fire; in which it was made red-hot, and the petre was found not to burn till a ſulphureous ſubſtance was put into it, ſuch as wood, coal, brimſtone, or the like, upon the injecting of any of which there were preſently produced a fire and flame, by which thoſe ſubſtances were conſumed. Whence Mr. Hooke argued, that the nitrous part of the petre was that, which corroded the ſulphureous body, and thereby the alcalizate ſalt of the petre was left behind, and augmented by parts of the coal taken into itſelf.

February 27. At a meeting of the Council were preſent

Mr. Henshaw, vice-preſident, in the chair,

Sir John Hoskyns,	Dr. Mapletoft,
Mr. Hill,	Dr. Croune,
Dr. Gale.	Dr. Browne,
Mr. Allen,	Mr. Creed,
Dr. Grew,	Mr. Hooke.

It was ordered, that Mr. Colwall be deſired to ſpeak with Mr. Cheney concerning Chelſea-College, and to know from him what farther intentions he has concerning that intereſt.

The duty and obligation of the library-keeper was agreed upon under the following heads:

1. The library-keeper ſhall attend two days in the week, viz. on Tueſday and Thurſday; on Tueſday from nine to twelve; and on Thurſday from nine to twelve; and in the afternoon from two till the preſident takes the chair.

2. He ſhall not lend out any book without an order of the council, or the preſident or vice-preſident in the chair.

3. That he ſhall make a perfect catalogue of the printed and manuſcript books after the moſt uſual method.

4. That he ſhall uſe no fire nor candle in the library.

5. He ſhall be provided always of pen, ink, and paper.

6. He ſhall give ſuch ſecurity to the Society for the keeping of the books, as the council ſhall accept of.

It was ordered, that Mr. Hooke have time till the Thurſday following to conſider of theſe propoſals, in order to return his final anſwer: And,

That upon his refuſal Mr. Perry[m] have the offer of keeping the library.

At a meeting of the Society on the ſame day,

The minutes of February 20 being read gave occaſion of diſcourſing farther about the hypotheſis, by which the phænomena of the barometer might be explained: and particularly, whether vapours aſcending or rain deſcending through the air charge the preſſure of the air beneath them with their whole weight.

Upon the mention of ſaltpetre, Sir John Hoskyns related the manner of making it in the Eaſt Indies to be thus: the inhabitants of the bay of Bengal dig ſmall trenches in the earth; which being filled with water is impregnated with nitrous particles, which being ſuffered to evaporate in the ſun till all the moiſture be exhaled, there will be found about the bottom and ſides of the trench much ſaltpetre, which they rake together, and ſo keep them: and that much was ſcraped off from old walls.

Mr. Henshaw obſerved, that in raking this nitrous ſalt after this manner, they rake together with the pure ſalt great quantities of the droſs and earth, which are uſually ſold with it: that there was ſome of this refined in India; but that for the moſt part it was brought unrefined; and that it was refined in England by the help of ſome alcalizate ſalts. Mr. Henshaw was of opinion, that ſaltpetre of itſelf contains no alcali, but that it was produced by fire.

[m] William Perry, M. A. and F. R. S.

Mr.

Mr. Hooke mentioned the way of making ſaltpetre with ſpirit of nitre and alcali ſalt mixed, whereby it appeared, that ſaltpetre might be compounded of an alcalizate and an acid ſalt mixed together, and ſo coaleſcing into ſaltpetre.

Mr. Henshaw affirmed, that there was a way, by which the whole body of ſea-ſalt might be converted into an inſipid water, viz. by heating of it very hot, and ſuffering it to run *per deliquium*; then heating the remainder, the whole body of ſalt will at laſt be converted into inſipid liquor, much after the manner, in which Dr. Dickenson had by long circulation converted the $\frac{18}{20}$ of the body of water into white earth.

Hereupon was occaſioned a diſcourſe about the cauſe of the ſaltneſs of the ſea, ſome being of opinion, that it proceeded only from the heat of the ſun upon the ſea in the Torrid Zone, though the greater part were of opinion, that it proceeded from the diſſolution of the ſalt minerals of the earth, either at the bottom or ſides of the ſea, or brought into it by ſalt ſprings made by the rain waters paſſing through ſalt mines.

Mr. Halley related two magnetical obſervations, which he had made in his voyage to Saint Helena:

The firſt was, that the dipping needle lay horizontal at about fifteen degrees on this ſide of the Æquinoctial line:

The ſecond was, that northward of that place an iron being held perpendicular, the lower end would attract the ſouth pole, and ſouthward of it the lower end attracted the north.

The reaſon of which Mr. Hooke ſuppoſed to be, becauſe the northern magnetical pole (as he had formerly ſhewed at the Society from the examination of the variations obſerved in captain James's voyage to Hudſon's Bay) was placed beyond the pole of the earth towards our horizon, and not between the pole of the earth and us, as Mr. Bond ſuppoſed; and becauſe the motion thereof was from weſt to eaſt contrary to what Mr. Bond ſuppoſed; which was, that it moved from eaſt to weſt: and becauſe that the ſaid pole was within the body of the earth, and not in the air, as Mr. Bond ſuppoſed.

The experiment ſhewed by Mr. Hooke was to ſhew, that vapours preſs only according to their own gravity, and not according to the ſpace, which they take up in the atmoſphere. This was done by a bladder blown up under water: but the conſequences of it not being ſo evident to ſome of the members preſent, it was deſired, that ſome more convenient glaſſes ſhould be prepared for it againſt the next meeting.

March 6. At a meeting of the Council were preſent

Mr. Henshaw, vice-preſident, in the chair,

Sir Theodore de Vaux,	Dr. Mapletoft,
Sir Jonas Moore,	Mr. Hill,
Dr. Croune,	Mr. Haak.
Dr. Grew,	

It

It was ordered, that Mr. Hooke ſhall employ ſuch perſon as he has propoſed or the writing letters, as he ſhall think fit.

At a meeting of the Society on the ſame day, Mr. Henshaw, vice-preſident, in the chair.

The minutes of February 27, being read gave occaſion of diſcourſing farther of the nature of ſaltpetre.

Mr. Henshaw was of opinion, that common nitre contains no alcalizate ſalt, till it is actually produced in it by heat; and that the heat alone without actual burning or inflammation would produce the ſame quantity of alcalizate ſalt, as would be produced from it by the burning it with charcoal, ſulphur, or the like.

Mr. Hooke conceived, that nitre from its manner of production might be ſuppoſed to conſiſt of two kinds of ſalts united together into one *compoſitum*; the one a very volatile and aerial ſalt rarefied and flying in the air; the other an earthy fixed and alcalizate ſalt mixed with the earth, by the union of which with one another they become ſtrictly joined into one body, which compoſes a vitriolate ſalt.

Objections were made againſt the ſuppoſition, that the ſea receives its ſaltneſs from the parts of the earth contiguous to it: and it was ſaid, that there was known but one lake in the world, that yielded ſalt water, though it is moſt probable, that, were that the cauſe, there would be many more found to contain ſalt water.

The manner of the dipping or inclination of the magnetical needle below the level was explained from the ſuppoſion of the magnetiſm of the earth; and the reaſon was ſhewn, why the dipping needle lies horizontal within the Atlantic Ocean at fifteen degrees of northern latitude.

The experiment produced was to examine the gravitation of bodies mixed with the air, but not united perfectly with it. But Mr. Hunt the operator not being able to procure convenient glaſſes, it was not farther diſcourſed of till the next meeting.

A diſcourſe was held about gun-powder, aurum fulminans, & pulvis fulminans.

March 13. Mr. Henshaw, vice-preſident, in the chair.

Monſ. Spanheim was admitted fellow.

The minutes of March 6th being read gave occaſion to diſcourſe farther about nitre, gun-powder, aurum fulminans & pulvis fulminans. And it was conjectured, that charcoal in gun-powder is of uſe chiefly upon the account of its containing a good quantity of alcalizate ſalt, and not ſo much on that of its being apt

apt to take fire; ſince it was obſerved, that pulvis fulminans, which was found to be much ſtronger, would be kindled without any mixture of charcoal or any other vegetable body. The like alſo was conceived to be the cauſe of the fulmination of aurum fulminans: and much was ſaid about the exiſtence of alcalizate ſalt in ſaltpetre. But there being no certain experiment alledged, that cleared that queſtion, it was referred to another occaſion.

In order to the better explaining the hypotheſis about fire, the experiment of the box for ſhewing the uſe of air in burning was again produced; and upon ſeveral trials with lighted coals ſet in an iron grate within the ſaid box, and blowed on with bellows ſhut up with them, ſo as only to make the included air circulate and work upon them, it plainly appeared, that the air, after it had been ſatiated by diſſolving and burning the lighted coals, was no longer able or fit to continue that diſſolution. But the coals ceaſed their ſhining and conſuming, and became black, without having any aſhes remaining on them: which farther ſhewed, that the uſe of bellows in blowing a fire is not the removing of thoſe aſhes, as was generally ſuppoſed; but the blowing upon the burning body a greater quantity of unſatiated air, which, like a new and hungry menſtruum, ſhould more powerfully work upon, conſume, and burn the heated body prepared thereby for that operation.

To make this theory yet more plain, another experiment, which had alſo been produced to the Society, was again ſhewn, viz. the putting a lighted wax candle through the top of the box into the ſatiated air within it. And it was by often repeating the experiment found, that the flame of the candle would immediately ceaſe as ſoon as the wick came within the body of the ſatiated air, and the ſteams of the candle aſcended without diſſolution or ſhining.

To make the matter yet plainer, the box was opened, after the coals ſeemed quite extinct, and the freſh air being blown upon the coals with the bellows, lying ſtill in their former poſture, they were immediately all of them again rekindled, and appeared to burn and ſhine as before, and the ſame candle being then again kindled without, and let into the ſame box, by the ſame hole as before, it was not extinguiſhed, but remained burning in the box, as if it had been in the open air.

Dr. Grew produced, &c. [a].

March 20. Mr. Henshaw, vice-preſident, in the chair.

The minutes of March 13, were read, which gave occaſion to diſcourſe concerning the ingredients of gun-powder.

Mr. Hooke conceived, that one great cauſe of the ſudden expanſion of the

[a] This minute is left thus imperfect in the Journal, vol. vi. p. 166.

powder

powder was the operation of the alcalizate falt in the charcoal, that ferved to compound the powder.

Sir JOHN HOSKYNS doubted of this, querying by what means we are affured of there being alcali in coals; and whether it could be thence extracted without actually reducing it to afhes. To which it was anfwered by Mr. HOOKE, that though poffibly it could not be actually extracted in the form of an alcali falt, yet that it produced its effects as much as if it were reduced; as appeared from the effects of it upon iron and copper in reducing them into fteel and brafs. Befides that the effect thereof feems manifeftly to be the very fame with the alcali in the pulvis fulminans, which is made of nitre and fulphur in the fame proportions, as in gun-powder, and differs only from it in having an alcalizate falt mixed with the other ingredients inftead of powder of charcoal: and that the fudden expanfion in each of them was occafioned by the falts working one upon the other in the way of diffolution: that DES CARTES's hypothefis of the turbinated motion of the nitrous parts is not fufficient to account for the effect; nor was there any ground to believe fuch a motion.

Sir JOHN HOSKYNS urged, that as there was very little alcali to be extracted out of a fmall quantity of coal any way, and fo it was not likely to be the caufe of fo great an effect, fo that even of that, which was, a great part of it would be left behind, after the gun-powder was fired in a mufket-barrel or the like; fo that it fhould rather feem, that the alcalizate part is ufelefs and infignificant, it being none of the parts, that expand and fly away.

Hereupon it was mentioned, that ROGER BACON in a book of his called *De mirabili poteftate Artis & Naturæ*, had manifefted by an enigmatical defcription thereof, that he well underftood how to make gun-powder, or a compofition, which fhould perform the fame effect: for in the edition of that book by ORONTIUS FINEUS in 1542, p. 44, he fays: "Præter hæc vera funt alia ftupenda naturæ; "nam foni velut tonitrua poffunt fieri in aere, immo majore horrore, quam illa, "quæ fiunt per naturam: Nam modica materia adaptata ad quantitatem unius "pollicis fonum facit horribilem, & corufcationem oftendit vehementem. Et hoc "fit multis modis, quibus omnis civitas & exercitus deftruatur ad modum artificii "GIDEONIS, qui lagunculis fractis & lampadibus, igne faliente cum fragore inef-"fabili Mædianatarum deftruxit exercitum cum trecentis hominibus. Mira funt "hæc, fi quis fciret uti ad plenum in debita quantitate & materia." And p. 52. "Item totum fic; fed tamen fatis petræ LVRV Vo Ro Po Vir Can Vtriet "fulphuris; & fic facies tonitruum & corufcationem. Sic facies artificium. Vi-"deas tamen utrum loquor in ænigmate vel fecundum veritatem."

It was defired by that Society, that as many books, as could be procured of the faid ROGER BACON, fhould be perufed; and it was wifhed, that they were all collected and printed, as being fuppofed to contain very many curious and ufeful matters.

Dr. GALE affirmed, that he had collected as many of the works of this author, as

as he could procure; and that his copy was that of Dr. LANBAINE, who had been very diligent and curious in that respect. Dr. GALE remarked likewise, that the king had a book of ROGER BACON out of Dr. PRIDEAUX's library, called the *Opus Majus*: and that his book of the prolongation of life, which was supposed to be lost, was affirmed by Dr. PLOT to be in the Bodleian Library; Dr. GALE adding, that he had the same book.

Dr. PLOT was desired to inquire what other works there were of BACON besides those in the possession of Dr. GALE, who affirmed, that his collection was full as good as that of Dr. MARSH at Dublin, whose copy of BACON's works was supposed to be the fairest extant.

Dr. PLOT mentioned, that there was one book of ROGER BACON in the library of University-College at Oxford, which he thought to be no where else in the world: and that Dr. LANBAINE had made an epitome of all the contents of the works of that writer, as he had also of all the manuscripts in the Bodleian Library.

Dr. GALE promised to lend his copy to Mr. HOOKE to peruse, when he should call for it.

After this the discourse was about fire, flame, heat, &c. and several objections were made against Mr. HOOKE's hypothesis of explaining it by the dissolution of bodies by the air. It was supposed, that the fire went out when all the pores of the air were filled so, as there was no more space left for the vapours and smoke to fly out of the coal. To which he answered, that the want of room could not be the cause of the extinction of fire, because if the air were drawn out of the vessel, wherein a candle or coal were burning, it would yet sooner go out; whereas there was thereby manifestly made more room; and upon the forcing and compressing more air into a vessel, the fire would continue so much the longer burning.

Dr. CROUNE supposed, that the spring of the air * * °.

Dr. HOLDER was of opinion, that the smoke is lighter than the air whilst dry; but that meeting with the moisture of the air it is precipitated down again, being made heavier.

The experiment of the sand falling in water, in order to examine how much the pressure of the water was altered thereby, was tried; but Mr. HUNT being unable to blow down to the bottom of the tube, it could not be certainly observed.

The same and another experiment were desired to be shewn at the next meeting.

° This minute is left thus imperfect in the Journal, vol. vi. p. 168.

1679.

1679. *March* 27. Mr. HENSHAW, vice-president, in the chair.

The minutes of March 20 being read gave occasion to discourse farther concerning the works of ROGER BACON; and it was judged very desirable, that all his works might be printed together: but that before this undertaking were begun, all imaginable care should be used to inquire what parts of his writings may lie dispersed in private libraries more than are to be found in the public; as his *Computus Naturalium* is in the library of University-College, and not in the Bodleian.

Mr. AUBREY affirmed, that Mr. WOOD in his English edition of the antiquities of Oxford [p] had given a more particular account of ROGER BACON's life, and had inserted a catalogue of his works.

Mr. AUBREY was desired to write to Mr. WOOD to send his catalogue of ROGER BACON's works.

He proposed, that there might be a catalogue made of all the books and treatises written and published by any of the members of the Society; which might then be more easily done, than if it should be omitted too long.

Dr. PLOT thereupon proposed it as a thing very desirable, that a general catalogue might be made of all the manuscripts, that could be found in England, whether in public or private libraries.

Dr. GALE moved, that Mr. HOOKE might peruse the epistle of ROGER BACON to Pope CLEMENT, and take notice of what was considerable about any invention supposed to have been the product of a much later age; since in that epistle, as Dr. GALE conceived, is the epitome of all his inventions mentioned elsewhere in his works: and that therefore Mr. HOOKE might soon see what might be expected.

Dr. PLOT was desired to collate it with the Oxford manuscripts.

He observed, that there was in some part of ROGER BACON's works mention made of a way of blowing up a ship, that had been sunk; which was by conveying fire down to the bottom of a ship through a pipe filled with a composition like gun-powder, and so setting fire to it.

Mr. HENSHAW related an experiment of making a piece of iron red hot by hammering, which was, that a small bar of iron about the bigness of one's finger forged to a small point, and then very nimbly hammered on an anvil, would by the continuance thereof be made red hot without the help of any other heat.

Mr. HILL proposed, that it might be tried, whether any thing either natural or

[p] This English edition was never printed.

artificial

artificial would burn in or under water. To which Mr. HOOKE answered, that this effect might be performed with gun-powder.

April 3. Mr. HENSHAW, vice-president, in the chair.

The minutes of March 27. were read, which gave occasion to discourse farther concerning the writings of ROGER BACON.

Dr. GALE produced a paper containing an account of an experiment pretended to be made by the said ROGER BACON, with a hazel rod, as it was described out out of a part of his works, called *De Motu Naturali Mirabili*, viz. "Surculus "unius anni suscipiatur, qui oritur juxta radices coryli, & secundum ejus longi-"tudinem dividatur, & separentur partes divisæ per spatium palmæ seu quatuor "digitorum; & unus teneat ex una parte extremitates duarum partium, & alius "ex alia parte similiter; & semper teneat æqualiter & leviter, ita quod sicut par-"tes in toto fuerant contra se positæ, sic teneantur infra spatium dimidii millia-"ris; incipient partes virgæ sibi appropinquare paulatim, sed fortius in fine, ut "tandem omnino concurrant & sint simul, extremitatibus tamen exeuntibus di-"versis; quia per violentiam detinentium præpediuntur: & est hoc valde admi-"rabile."

Mr. HOOKE was desired to consider of that paper, to see if he could explain the meaning thereof.

Mr. AUBREY was desired to write to Mr. ANTHONY WOOD, to understand from him what account he designed to publish of ROGER BACON in his history of the antiquities of Oxford, now printing in English.

Mr. HILL mentioned a manuscript of ROGER BACON in the possession of Dr. WINDET [q], intitled, *De Dictis & Factis falsorum Mathematicorum & Dæmonum.*

The vice-president was of opinion, that the catalogue of his works was not proper to be printed, till a farther search had been made.

Mr. MOSES REUSDEN, recommended by Mr. EVELYN, sent in to the Society a treatise of his of the nature of bees, intitled, *Monarchy founded in Nature, and proved by the History of Bees; shewing their admirable natures and properties, their monarchical government, and their wonderful generation; with a discovery of improving them, by taking their honey without destroying the bees; with particular direction for keeping them in colonies. By Michael Reusden, apothecary, bee-master to his majesty; dedicated to the king's most excellent majesty.*

The contents of the several chapters being read, the author was called in, to know what his desires were, which he expressed to be, to have his treatise perused by the Society; and that, if they should think fit, upon their scrutiny and exa-

[q] JAMES WINDET, M. D. author of the book *De Vita functorum statu.*

mination thereof, they would grant him a license for printing it. Being asked several questions, he answered concerning his experience, that he had made many observations and experiments on bees for four years past, after this new way: That the bees slept almost all the winter, and did not spend upon their stock. That he had read Mr. BUTLER, and divers other authors, about bees: and that in what particulars he differs from them, he assigns both his experiments and reasons for so doing. He was willing to leave his book with the Society for their perusal, and was appointed to come again at the next meeting, it being recommended to Dr. CROUNE to peruse the book, and to give his opinion of it.

A farther discourse was held concerning ROGER BACON, and Dr. GALE produced the following extract from his own manuscript, p. 684 of that writer, *in arte experimentali*, containing the description of gun-powder: "1. Quædam experimenta tantum terrorem visui incutiant, quod coruscationes nubium longè minus & sine comparatione perturbant; & experimentum hujus rei capimus ex hoc ludicro puerili, quod fit in multis mundi partibus, scilicet, ut instrumento facto ad quantitatem pollicis humani ex violentia illius salis, qui sal petre vocatur, tam horribilis sonus nascitur in ruptura modicæ rei, scilicet modici pergameni, quod fortis tonitrui sentiatur excedere rugitum, & coruscationem maximam sui luminis jubar excedat."

Mention also was made of his way of blowing up sunk ships.

Sir JONAS MOORE said, that the way of blowing up ships by gun-powder, to which fire was conveyed under water, by means of a pipe, and a train-match, is now frequently practised, as it was heretofore practised at Woolwich and Sheerness.

He related also an observation of his about red-hot bullets shot out of a gun, that the said bullets would continue as red-hot as they were shot till they fell; which he conceived to be caused by the swiftness of their motions through the air. This, he said, was observed at Hull.

Mr. HOOKE mentioned his observation of the melting of a small particle of steel struck off by the violence of the stroke of a flint; the heating of iron by filing, hammering, grinding, rubbing: that the dust thrown off from the grindstone in grinding knives, razors, and the like, are melted globules of the steel: that the particles of flints and other hard stones upon striking one against the other will grow red-hot and shine; as will also a tobacco-pipe clay, and several other clays and earths hardened by burning.

Mr. HENSHAW observed, that the iron heated red-hot by hammering must be small; otherwise the experiment would not succeed.

Sir JOHN HOSKYNS said, that Mr. AUBREY had lighted a pipe of tobacco by an iron so heated by hammering.

Mr.

Mr. Hooke related, that he had fired a gun-powder serpent, which had burnt under water, and came out again burning after it had passed through a good space of water.

A discourse then arose about substances burning in water, as camphire, naptha, petroleum, &c.

Dr. Holder related, that sometimes rivers had been guarded by petroleum swimming upon the water; for that any part of it being fired, it would all of it presently take fire, and set fire to the ships swimming in it: and that the king of Achin was said to have made use of it.

Sir John Hoskyns related, that the steam of the varnish used by cabinet-makers would sometimes take fire, and had been observed to run along till it set fire to the varnish in the vessel.

Mr. Hooke related, that he had observed something of this nature of oil of turpentine; which being mixed with an acid liquor, set it into a most violent fermenting, heating, and smoking, insomuch that it could not be endured in the room: being set in the chimney corner, where a fire was, the smoke immediately caught fire, and burned with a blaze almost a yard high.

Mr. Slare presented the Society with a phosphorus of his own making, affirming it to be a compound substance, and not like the Bononian stone. This was examined by several present, and judged to be as good as any, which they had seen.

Mr. Haak presented to the Society for their library five small books sent to him by Christopher Sturmius, professor of mathematics and philosophy at Altorf; viz. 1. *Dis*** de Mathematicis.* 2. *De Authoritate interpretum Naturæ ac speciatim Aristotelis.* 3. *De Clepsydrarum phænomenis & effectibus.* 4. *De Cartesianis & Cartesianismo.* 5. *De Visionis Organo & Ratione.*

He presented also to the Society for their repository some papers of salts and sulphurs, which Mr. George Trumball had taken up and brought from the top of the pike of Tenariffe.

Dr. Grew produced some salts, which he had extracted out of the waters about London.

He likewise communicated several anatomical observations, with the following account of them;

1. *Placenta Uterina Muliebris*, excarnated; that is, with the blood and smallest capillary vessels cleansed away: together with a certain glandulous substance of a yellowish colour being the true parenchyma, by the means of which the serum or lymphous part of the blood seems to be separated into the membranes of the secundine.

2. The uterus of a bitch, in which the os internum was of a very peculiar ſtructure, being a nervous caruncle opening with four little lips croſs-wiſe; that is, not horizontally, as in other animals, but perpendicularly; whereby the paſſage from the uterus is made more difficult. From which it may be, as from one cauſe, that a bitch is ſeldom or never known to bring an abortive birth.

3. The guts of a caſſiowary with the ſtomach and crop, or rather the gula; this and the rectum being bigger than in a horſe; the ſtomach on the contrary proportionably ſmall, and only membranous, not griſtly.

4. The diaphragm of a cat, divided into two muſcles by two narrow membranes, being two ſemidiameters, and having a third round one in the centre, all three anſwerable to ſo many tendons; by which upon every reſpiration the diaphragm is made to ſtand tenſed and tite like the parchment of a drum.

5. A cat's tongue, which is all over not only rough, but ſharp with bony thorns, ſtanding as the teeth or wires in a wool-card. So that a cat carries her curry comb in her mouth, only uſing her tongue to ſcrat withal, where a dog uſeth his teeth or claws.

6. The cryſtalline humour of a cat's eye, which in drying breaks every where from the centre of both convexities in regular triangles.

7. The foremoſt teeth of the upper chop of a rabbet, which are four. The two outmoſt are the *inciſores*, common to this and ſome other animals; but within theſe are two more very peculiar, which may be called the gage-teeth; becauſe they hinder the other teeth from ſtriking too far, ſo as either to diſlocate the chop, ſtrain the muſcles, or cut the gums; which might otherwiſe eaſily happen in this animal, becauſe the fore-teeth are ſo ſharp and chiſſel-wiſe, and becauſe it cuts or chops its meat ſo quick. And to ſerve the better for the ſame purpoſe, the ſaid teeth are not made ſharp, but flat-headed.

8. The fore and hinder-feet of a rat, together with thoſe of a mole; which being compared ſhewed the exactneſs of their contrivance for the uſe of thoſe animals, the hinder-feet of a rat being at leaſt three times as big as thoſe before, becauſe he often makes ſtrong and high leaps: thoſe of a mole three times leſs, becauſe he works only with his fore-feet.

9. The bony tendons of the leg of a cock, which are alſo in other fowls, being neceſſary to keep the ſtanding poſture more ſteady, as that, in which they keep, as well aſleep as awake.

Mr. Hooke ſhewed an experiment in mechanics; which was a way how to take notice of all the rain, that falls, and was deſigned as a part of the weather-clock. The contrivance of this invention was the ſuſpending the bucket, that was to receive the quantity of rain, that falls at any time (whether more or leſs) ſo that according to the quantity therein contained, the place thereof ſhould either be

be higher or lower; but certainly determined. This was performed by a counterpoise to the said bucket. The counterpoise was contrived two ways, either by a string of leaden bullets so ordered, that when the bucket was quite empty, all the bullets rested upon a table; but when there fell as much water into the bucket, as equalled the weight of one of the leaden beads, then the bucket descended one space, and one bullet was lifted up; and when twice as much, two bullets, and when three times as much, three bullets were lifted, and so forward, till all the bullets were lifted up, and the bucket had descended to its place of emptying; whereupon the chain of bullets presently descended and lifted up the bucket into its empty place. But because this motion proceeded with jumps, and was not continually equal, therefore a second contrivance was also shewn; which was this:

The counterpoise to the bucket, when empty, was a cylinder immersed into water, mercury or any other fluid; which cylindrical counterpoise, according as the bucket received more and more water, was continually lifted higher and higher out of the water by spaces, always proportioned to the quantity of water, that was contained in the bucket. And when the bucket was filled to its designed fulness, it immediately emptied itself of the water, and the cylinder plunged itself into the water, and raised the bucket to the place, where it was again to begin its descent.

This contrivance here made use of was declared to be useful for making a new and useful beam for examining the weight of bodies without any trouble of adjusting, the rising of the cylinder immediately shewing the determinate weight of any body put into the scale without any farther trouble.

April 10. Mr. HENSHAW, vice-president, in the chair.

Upon reading the minutes of April the 3d, a discourse was occasioned concerning the time, when guns were first invented and brought into use: and it was observed by Mr. HENSHAW, that when they were first used, a bow was joined to the same stock, which served for the musket, and thence it was called by MENAGE *Arcubugio*. These were used in the time of king HENRY V. which was long after ROGER BACON's time.

Hereupon it was debated, whether SWARTS were the first inventor of gunpowder, or only of the method of making use of it in guns; and whether he were not rather the inventor of guns than of gun-powder; since it was plain from several passages in ROGER BACON's works, that not only that writer was not ignorant of the way of making such a powder, but that even the powder itself was very commonly known and commonly made use of for making fire-works, not only by boys here in England, but generally in most other places. It was therefore desired, that inquiry might be made into the times of their living.

Mr. HOOKE remarked, that though they had not gun-powder, yet that by the help of great springs they were able to do very great things: that besides divers other

other ſpringy bodies, they knew the uſe of the ſpring of the air, as is evident in HERO's works, eſpecially in that mentioned by VITRUVIUS for the quenching of fire.

Dr. ALLEN mentioned, that CÆSALPINUS had given a good hint for the circulation of the blood, and was alledged by ſome, as if he had been the firſt diſcoverer. But his concluding his diſcourſe with a query, what became of the blood after it had come into the right ventricle of the heart, plainly ſhewed, that he underſtood not the true circulation of the blood ſince found out by Dr. HARVEY.

Mr. HENSHAW gave an account of ſome trials, which he had made with the phoſphorus preſented by Mr. SLARE. One of which was, that he had found, that it would receive a very briſk light from the evening light of the air, but a very duſky one from that of a candle, and none ſenſible from the rays of the moon. It was deſired, that he would try to increaſe the light of the moon by a burning-glaſs, to ſee whether it would produce any conſiderable effect.

Dr. CROUNE mentioned, that in BARTHOLINUS's *Acta Medica*, there was mention made of two liquors, which being put together produced flame.

Dr. ALLEN read a ſhort account of ſome extracts made by himſelf out of medicinal waters near London, viz.

" *Auguſt* 1, 1663. I diſtilled ſix gallons of Chigwell waters, out of which " I extracted of ſalt ʒx—℈ß, and there remained of calx ℥i. and ℈ij.

" I extracted out of the like quantity of the * * waters by evaporation ʒxi. " and ℈i. of ſalt and ʒij. ß. of calx.

" There was of the ſaid ſalt extracted by evaporation cryſtalliſed ʒij. ß. I extracted out of three gallons of North Hall waters of ſalt ℥iij. of calx ʒij. and ℈ij. " and from three gallons of Barnet water of ſalt ℥i. and ʒvii. ß. and of calx ʒiij. and ℈. ß."

Mr. HENSHAW obſerved, that the beſt way of extracting a ſalt was by firſt putrifying the water, letting it ſtand by itſelf, and then diſtilling it.

He added, that ſome ſalts are extremely penetrating, ſo as to pierce through the ſubſtance of the pipkin: and that he had obſerved, that horſe-dung would ſend a volatile ſalt quite through a wall of four inches thick, which would ſhoot and grow on the other ſide into a kind of nitre.

Mr. HOOKE ſhewed his experiment; being an hygroſcope made of ſeveral ſhort gut ſtrings, or any other ſhrinking body ſenſible of the moiſture and dryneſs of the air. Theſe were united together by the means of iron wires made after the manner of beams, that the ſhrinking and ſwelling of every one of them was communicated to the laſt, which moved the index, by which means the leaſt mutations

tions of the air, as to dryness and moisture, were made very sensible, and the contrivance of it was so ordered, that the least degree of power, which it had to stretch or shrink the string, would easily move and make a sensible alteration.

Some objected, that gut strings would in process of time lose the power of shrinking and stretching, and so were unfit for such a work. But it was answered, that those strings were not intended for a constant hygroscope; but only for the present use, to shew the manner how to make use of these, or any other shrinking or swelling body for the shewing of the effect desired: and that at the next meeting there would be one of another substance produced, that would not be liable to those objections.

April 17. Mr. HENSHAW, vice-president, in the chair.

Dr. GALE produced some of Dr. PLOT's queries and other papers, which were dispersed among several members of the Society present, who had not them before, and were desired to consider them, and promote the design as much as they could.

After which the minutes of April the 10th being read, and the Society discoursing farther concerning the time of inventing gun-powder and guns, Sir JOHN HOSKYNS mentioned the picture of an old musket in the hangings of the prince's chamber near the house of lords, where one holds the gun while another gives fire to it. He added, that KIRCHER in his *Mundus Subterraneus* had collected most things concerning guns and gun-powder.

A book of ROGER BACON was produced, called his Epistle, which was published by Dr. DEE. It seemed to be on the same subject with his epistle to pope CLEMENT IV. but very much short of that in the possession of Dr. GALE. It was desired, that that epistle in the hands of Dr. GALE might be perused, to see, whether it were fit to be printed, as preliminary to his other works, as seeming to contain an account of all his other writings, which were thought very considerable, and might prove an honour to the English nation; especially as he appeared to be the first, who had begun experimental philosophy. Dr. DEE remarked, that he lived about the year 1240: but Dr. CROUNE observed, that who was tutor to ROGER BACON lived in the time of king EDWARD I.

Dr. CROUNE gave an account of Mr. REUSDEN's book on bees, which he had perused; that the part of it about the education of bees contained many good observations well made and related; but that what the author said about the king-bee and its sperm, out of which he supposed the bees to be produced, appeared to be mere fancy, and was contrary to the opinion of other writers.

That as to the diseases of bees, JOHNSON affirms, that they will fall into a diarrhæa, and wear away by it.

Mr. HOOKE shewed his experiment, which was a way of making an hygroscope with pieces of elm cut across the grain, the better to be able to be sensible of

of the changes of the air, so contrived as to make the same as much and large as should be desired. That produced by him consisted of twenty-four feet of the said pieces, and might be made of an hundred or two hundred feet of the said pieces, and yet so ordered, that the shrinking and swelling of every foot of it was made sensible, and accumulated all in the last. He was desired to complete this invention for the weather-clock, which was now near finished.

Dr. GREW read and delivered in a paper of the things, which he had shewn at the meeting of April 3. which paper was to be inserted in the Journal-book of the Society.

April 24. This being Easter week very few of the Society met.

Dr. GREW having some part of his catalogue of the repository fitted for the press, proposed to read it at this meeting, which accordingly at the desire of the members present he did, after the minutes of April 17th had been read.

Sir JONAS MOORE, the vice-president, took the chair; and as soon as Dr. GREW had read his observations *De Homine*, without at all entering into the debate of the matters, the Society rose.

May 1. Mr. HENSHAW, vice-president, in the chair.

A letter from Sir PETER WYCHE, directed to Mr. HENSHAW, dated at Hamburgh, April 18, 1679, was read, giving an account of a packet of letters which he had received from Sir JOHN PAUL, and conveyed by one JOSHUA JOHNSON; offering likewise to serve the Society to the utmost of his power in those parts.

The letter and packet of Sir JOHN PAUL being received and communicated to Mr. PITT was likewise produced.

The letter gave an account of his endeavour to procure from Mr. president RESEN his collection of new maps and descriptions of Denmark, desired by Mr. HENSHAW, in order to their being inserted in the first volume of *the English Atlas*, publishing by Mr. PITT.

With this letter came a packet from Mr. RESEN, containing first his letter, in which he gave an account of his whole undertaking in general, for the particulars whereof he referred himself to the other papers, which were then in Mr. PITT's hand, and declared himself willing to part with the whole work, now almost ready for the press, at the same rate, which it had cost him, viz. two thousand seven hundred rix dollars. It was desired, that Mr. PITT should be consulted with on this affair, that so Mr. HENSHAW might return Mr. RESEN an answer suitable to the civility proferred in his letter.

Together with this letter were shewn two of Mr. RESEN's maps, the one of the island of Gothland, and the other of the island of Borringholm, both very particularly

ticularly and curiously described: as also the first sheet of a discourse of Erasmus Bartholine, in the press, intitled, *De Aere Hafniensi Dissertatio*, giving an account of the situation and air of Copenhagen.

Dr. Grew then read a part of his description of the repository, being his chapter about animals and animal substances therein kept.

Mr. Hooke produced his new way of ordering pieces of elm for the making of an hygroscope: upon which it was desired, that there should be one of this kind prepared to stand in the meeting-room of the Society: as also that a barometer, after Mr. Hooke's way, should be prepared for the said room.

May 8. Mr. Henshaw, vice-president, in the chair.

He returned the phosphorus presented by Mr. Slare, and gave an account of some trials made therewith. Among many others it was very remarkable, that by several trials he could not perceive, that the light of the moon had any sensible operation upon it at all, though he had tried it to the best advantage. And Mr. Hooke suggesting, that possibly by collecting the radiation of that body by a burning-glass, it might have some sensible effect of the stone, it was desired, that he should make trial thereof between that and the next meeting, and give an account of it.

The maps and ground-plots of several towns in Denmark sent by Mr. Resen to Mr. Henshaw were produced and shewn.

Dr. Grew read a section of his discourse and description of the repository.

Mr. Henshaw observed by the way, that rivers, which are much frequented by crocodiles, have their water made so offensive by their musky smell, that they cannot be made use of by the inhabitants for drinking.

Mr. Crisp related, that in some of the rivers of Africa, where the Gambia company trade, crocodiles are so frequent, that twenty or thirty sometimes will follow a bait upon those rivers.

Sir John Hoskyns mentioned an old statue at Rome of the river Nile, wherein men were carved killing of crocodiles.

Several queries were made concerning the rattles of rattle-snakes, whether they were the epiphysis of the tail-bone, or the end of the skin cast off every year?

As also concerning the unicorn's horn, whether it were the horn or rather the tooth of the fish caught about Greenland?

Mr. Hooke produced and read a paper, containing a description of the way of flying, invented and practised by one Monf. Besnier, a smith of Sable in the county

county of Mayne, the contrivance of which consisted in ordering four wings folding and shutting like folding *, to be moved by his hands before and legs behind, so as to move diagonally, and to counterpoise each other: by which he was, it was said, able to fly from a high place cross a river to a pretty distance.

Dr. CROUNE remarked, that in the Paris Gazette there was mention made of one, who had lately flown there from the top of a steeple to the ground at a considerable distance, and had lighted safe.

He observed likewise, that the bodies of fowls were made in all parts light and strong, and particularly in their bones.

Mr. HOOKE produced a model of the contrivance of the wings made with pastboard, whereby both the manner of the motion of them diagonally, and also of their opening and shutting, was explained; though he supposed that not to be the best way contrived for the performing that effect after that manner, but that the same sort of wings might be much more advantageously made and used for that effect.

Sir JONAS MOORE related, that one Mr. GASCOIGNE had, above forty years before, made a contrivance for flying, by which he had been able to make a boy at Knaresborough fly a considerable way; but that he being frightned in his flight by the acclamations of the spectators, fell down before he designed to alight, and though not much hurt, would not attempt it any farther.

Mr. HENSHAW conceived, that by reason of the weakness of a man's arms for such kind of motions, it would be much more probable to make a chariot or such like machine with springs and wheels to move the wings, that should serve to carry one or more men in it to act and guide it.

Several relations were mentioned of the strength of the wings of fowls, and amongst the rest, Mr. HENSHAW took notice, that he had known a man of fifty years old beat down by the stroke of the wings of a swan.

Mr. DANIEL COLWALL presented to the Society for their repository the pizzle of an unicorn fish.

May 15. Mr. HENSHAW, vice-president, was present, but the Society did not sit.

Monf. ROMER of the royal academy of sciences at Paris was admitted to be present, while Dr. GREW shewed some anatomical observations, and left the paper describing them to be inserted in the Journal.

1. The skin of a man's head, and part of that of the arm, both tanned, making almost as tough and firm leather, as that of any cow's hide.

These

These two pieces compared together shewed the thickneſs of the ſkin in the hinder part of the head and neck eſpecially above what it is in other parts, the better to ſecure the brain and ſpinal marrow from cold.

2. Part of the membranes of the abdomen of a flying ſquirrel, which is all the muſcles, which that animal hath there to make him the lighter for his high leaps and falls.

3. The prickles of a hedge-hog, the fibres of which give them their ſtrength and ſtiffneſs, ſtanding all round in the circumference as in a wheaten ſtraw; in the middle ſpungy like a quill or ſoft pith, for the greater lightneſs.

4. The foremoſt and hinder claws of a cat; the latter but four, the former in number five; the latter very blunt and broken-pointed; the former always as ſharp as needles, very like in ſhape to the claws of a tyger.

5. Part of the pia mater of a bull's brain duplicated between the cerebrum and the cerebellum, being half an inch thick.

6. The tongue of a trout, whereon there are four ſharp hooks, two on each edge, ſo that this fiſh may be ſaid to angle with his tongue.

7. The bony fibres of the chap-muſcles of a lobſter ſo made for greater ſtrength and ſteadineſs in apprehending the prey.

8. Stones out of a woman's gall, always angular, as here, and not round, as the bezoar is.

9. Two bones taken out of the heart of a cow, which ſeemed to be as hard and white, and therefore as full of volatile ſalt as thoſe in a ſtag's heart: of what ſpecial virtue it was no certain experiment had been made.

10. The weaſand of a caſſawary, together with the tongue.

This gave an ocular demonſtration of a miſtake of ALDROVANDUS, who affirmed, that this animal hath no tongue; and to whom Mr. WILLUGHBY alſo in his *Ornithologia* ſeemed to aſſent.

In this weaſand the rings were entire, but cartilaginous, and very ſoft.

At the bottom of it towards its diviſion into the two lobes of the lungs are two muſcles, one on each ſide, which ſerve to put it down, or draw it on one ſide or the other, according as there is occaſion to give way to the deſcending meat or the gorged ſtomach.

11. The weaſand of a Japan peacock.

At the lower end thereof are a pair of muscles for the same purpose as in a cassawary.

The rings are intire, and hard and bony.

At the upper end next the epiglottis is a ridged prominency in the middle.

12. The weasand of a dog, wherein the rings are not intire, but their ends joined by a membrane, which runs through the length of the weasand.

By these compared together it appeared whence in part these and other animals have either a tunable, that is, variable voice, or how a strong one. That of a dog is variable, partly because the rings of the weasand not being intire are dilated or contracted, according as the dog's voice is bigger or smaller.

That of a Japan peacock is little variable, because the rings being intire can neither be dilated nor contracted; yet it is very strong and loud, because the rings are not soft, but hard and bony, the prominency above-mentioned adding also to the shrillness of the sound.

That of a cassawary is neither variable nor loud, because the rings are both intire and soft.

13. The kidnies of a cat in two figures: the former shewing the inosculations of the vessels or veins on the outside, the coats being taken off; the other the inner part of the kidney, cut down the middle length, shewing the three distinct regions of the kidney, viz. the glandulous, the fibrous, and the middle, where the glands, fibres, and vessels, all meet together; being a curious mechanical contrivance for the separation of the saline serum of the blood from its oleose parts. For by the vessels or arteries the blood is brought to the middle region, where the glands and fibres meet, and are mixed; the saline serous part is readily received or imbibed by the lean fibres, and by them carried off into the pelvis; the oleose and gummous part by the fat or unctuous glands, and by them is discharged back into the veins.

14. The skulls of a weesel and polecat.

15. The skull of a fox.

16. The skull of an owl.

17. The skull of a rabbet.

In which, among other things, is observable the various opening of the ear. In a polecat and weesel it opens level and forward, the concha being prominent just behind, as most proper for these animals, that seek their prey or food neither above nor below, but on the ground. In a fox it opens also forward, and the bone prominent behind, but obliquely downward, the better to cast into the ear a sound, that comes from above, proper for his watching of fowls, at roost. In an owl it opens

opens alfo forward, and is prominent behind, but obliquely upward; proper for his taking of any noife below him, as he fits in a tree, or is pearched elfewhere. Contrary to all the reft, a rabbet's ear opens backward, having a fyphon or tubulary bone about a quarter of an inch long, reclinated or pitched obliquely backward on the entry of the tympanum, made proper for the animal to hear all noifes, as he ftands ready for flight. And it is obferved, that a rabbet always hearkens with his breech towards you.

18. The fkull of a cat, in which the hardnefs of the concha above what appears in the fame bone of many other animals is obfervable; as alfo its thinnefs, whereby there is made a very ftrong repercuffion of the found, fo that it feems, that this animal hath a quick ear.

The cranium of the cat is divided perfectly into two rooms, one for the cerebrum, the other for the cerebellum: whereby perhaps this animal's brain is more fecure from turning, as we fay; that is, the cerebellum preffing on the cerebrum, as fhe runs along very high and fteep places.

The atlas of a cat hath a *proceffus dentiformis* contained in the cavity of the next vertebra by a ftrong tranfverfe ligament.

The bone over the cerebellum of a fox is like a curious canopy in the fhape of a fcollop fhell. Here alfo is obfervable the amplitude of the temporal mufcles by the ftanding out of the bones to give way to them.

The great and upper teeth alfo of a fox have a triple indenture; thofe of a dog but a double one.

It is likewife obfervable, that the long teeth in a fox or dog are fo placed, and the jaw fo fhaped, that the great ones only meet; thefe never, left upon the breaking of bones they fhould break or loofen one another.

Mr. Hooke gave an account of his trials made with the phofphorus of Mr. Slare, that having expofed it for feveral minutes to the rays of the moon at full and near the meridian, he could not perceive the leaft appearance of light, though carried into a very dark room; and that he was not able to find any effect of the light of the moon, tho' caft upon the phofphorus by a large reflecting burning glafs: which agreed with the obfervations made of the fame by Mr. Henshaw.

The experiment defigned to be exhibited by Mr. Hooke being an experiment of light to be fhewn by the rays of the fun, could not be performed by reafon that the afternoon proved cloudy.

May 22. Mr. Henshaw, vice-prefident, in the chair.

The minutes of May the 8th and 15th were read: whereupon the caufe of the faintnefs of the beams of light reflected from the full moon were farther difcourfed

of,

of, upon the occasion of their not producing any ſenſible effect upon the new phoſphorus.

Dr. GREW read the third part of his deſcription of the repoſitory, being about the flying animals there kept.

Dr. PLOT mentioned an invention made by a perſon in Kent, which was a kind of clock made by the paſſing of fine ſand through a ſmall hole ſomewhat after the way deſcribed by BELFORIUS.

Hereupon mention was made of divers other ways of making hour-glaſſes or clocks, viz. by the paſſing of the air, incloſed by an inſtrument, through a very ſmall hole.

A ſtranger being preſent, the weather-clock now finiſhed by Mr. HOOKE was omitted to be ſhewn till the next meeting, when it was to be carried to Mr. HUNT's lodging, that he might attend it and ſupply it with freſh papers.

Mr. HOOKE then had leave to introduce Monſ. PAPIN, a gentleman, who ſtaid in the outer room with an intention to ſhew an experiment to the Society, which was ſingular and new.

He being brought in, ſhewed a ſmall glaſs, which he had in his pocket, wherein were contained ſeveral ſmall pieces of hartſhorn, which he had ſoftened by a new way, that he had found out, of boiling them. Theſe pieces were examined by cutting and biting, and were found to be not much harder than a ſticky and ſeeded carrot-root.

He affirmed, that he had a method of ſoftening other bones alſo by boiling, and likewiſe ivory.

Being demanded, whether any of the ſubſtances ſo ſoftened would by keeping, or any other way, that he knew of, be again hardened? he anſwered, that he was not ſure of that effect; though he thought, that theſe ſubſtances, which were this way ſoftened, could ſcarce be reduced to their former ſolidity.

He was deſired to try what effect this kind of boiling might have upon barley, wheat, malt, or the like for making liquors: as alſo, to let the Society ſee an experiment of its effects upon other kinds of bony ſubſtances, and fleſh; which he promiſed to do.

May 29. Mr. HENSHAW, vice-preſident, in the chair.

Monſ. PAPIN, as he had been deſired at the laſt meeting, produced three glaſſes of liquors made by his trials upon wheat, barley, and malt, boiled after his new way, to ſee what effect it would have on liquors. They were found to be very ſtrong

ſtrong tinctures of thoſe ſubſtances; but being but ſmall quantities, and not fermented, little could be determined concerning them.

The minutes of May the 22d being read, Mr. HENSHAW produced a piece of the hartſhorn, which was ſo very ſoft at the laſt meeting, and was now hardened again to a very great degree, and very white: but upon ſcraping of it, it was obſerved to be much more brittle than common hartſhorn, the greateſt part of the glutinous gum thereof having been fetched out of it by the boiling. Nevertheleſs it was ſuppoſed, that this, as alſo ivory, might be very uſeful in mechanical matters, by reaſon of its eaſineſs to be carved and ſhaped when ſoft, and its hardening again ſo quickly to ſo great a degree with whiteneſs.

Query, whether it might not be dyed into various colours, when ſo ſoftened, or after it is again hardened.

Monſ. PAPIN then produced ſome calve's feet dreſſed after the ſame manner; which being examined, were found to have the bones thereof ſoftened, as the hartſhorn was at the laſt meeting, and the fleſh thereof was notwithſtanding very well taſted, and as firm as if boiled the common way. He was deſired to communicate to the Society what farther proſecution he made of this his new invention.

Dr. GREW produced and read two letters, the one from Dr. COLE, the other from Mr. RASTELL incloſed in the former, containing a deſcription of the way of making ſalt at Droitwich, in anſwer to the queries, which had formerly been ſent to Cheſhire; together with the quality, virtues, and uſes, of that ſalt, brine, and ſalt-ſpring.

Mr. HOOKE read a tranſlation of a chapter of the Italian book of father FRANCISCO LANA, intitled *Prodromo*, being an explication and demonſtration, as he ſuppoſed, of a way to make a veſſel to ſwim and float in the air, ſo as to carry in it one or more men with other heavy bodies, invented, as he ſays, by himſelf, in order to make flying practicable, which had before been thought impoſſible [z].

Mr. HILL produced from Mr. THOMAS CRISPE a parcel of grain gold, which Mr. HOOKE having examined with a microſcope, found to conſiſt of ſmall bulks of very irregular figures; but that moſt of them ſeemed to have been melted, all the angles of them being round and ſwelling, and not at all like the angles of ſand, which are ſharp; and it was conceived, that the ſame kind of figures would be produced, if the gold, when melted, were daſhed into a heap of ſand.

The Society then went to take a view of the new weather-clock, which was ſet up in Mr. HUNT's lodgings, made to keep an account of the quantity and time of all the changes, that happen in the air, as to its heat and cold, its dryneſs and moiſture, its gravity and levity; as alſo of the time and quantity of the rain,

[z] See Mr. HOOKE's Philoſophical Collections, n° 1. p. 18.

ſnow,

ſnow, and hail, that fall: all which it ſets down in a paper, ſo as to be very legible and certain.

June 5. Mr. HENSHAW, vice-preſident in the chair.

Mr. HOOKE mentioned, that he had ſeen a letter of Mr. HALLEY to Sir JONAS MOORE, written from Dantzick, giving an account of his ſafe arrival there; of his delivering his letters to Mr. HEVELIUS, and of the very kind acceptance of them and entertainment of him; of Mr. HEVELIUS's great eſteem and reſpect for the Royal Society: that he, Mr. HALLEY, had ſeen Mr. HEVELIUS's obſervations and inſtruments, and found them very extraordinary, but all with common ſights: that he had ſeen Mr. HEVELIUS make obſervations with thoſe inſtruments of the diſtance of two fixed ſtars, and that they were capable of making them to half a minute; but that he was not able to do this nearer than to a minute: that his contrivance for ſetting his inſtruments to the plane of the ſtars was very good: that he had publiſhed the ſecond part of his *Machina Cæleſtis*, containing his obſervations of the fixed ſtars; and that he had ſent ſome copies of that work to England.

Two letters of the ſecretary were read, the one to the Abbé de la ROCHE, the other to Monſ. JUSTEL, in order to begin a correſpondence with them concerning philoſophical ſubjects; which letters were approved of by the vice preſident.

The minutes of May the 29th were read; which gave occaſion to diſcourſe farther about the ſoftening of the bones in fleſh boiled; and Monſ. PAPIN being preſent, he was aſked, whether he uſed water in that operation; which he denied, affirming, that he put no water to it in the boiling.

Mr. HOOKE propoſed it as a very uſeful mechanical operation for making of inlaid works with bones or ivory, to ſtain them with colours while ſoft, to ſee, if they would hold thoſe colours, when dry and hardened again: and he affirmed, that he knew a method of dying ivory as black as jet, and ſinking the colour into a conſiderable depth, ſo as to be very laſting, without ſoftening the ivory; but that he could not do the ſame thing with other colours.

Hereupon ſome diſcourſe was occaſioned about China ink, ſome ſuppoſing it to be made of burnt bones; others of very fine lamp black, though others thought it might be an inſpiſſated juice.

Mr. COLWALL mentioned a way of making very good ink, caſting a little upon a purple, which was with deep coloured claret, with galls and copperas, without gum.

Sir JOHN HOSKYNS ſuggeſting, that Monſ. PAPIN's way of ſoftening bones would be of good uſe for cooking of bony fiſh, which were troubleſome in eating, the latter added, that he had tried that effect, and found, that he could ſoften fiſh-bones as well as others.

The

The obſervations made at the laſt meeting on grain-gold were diſcourſed of; and it was obſerved by Mr. Henshaw, that the firſt gold brought from Peru was grain-gold; but that afterwards the induſtry of the planters found out the mineral, from which it might be drawn by quickſilver.

Sir John Hoskyns ſaid from the report of ſome other perſon, that the lead-mines in Wales contained a greater proportion of ſilver than moſt other mines in Europe, and as much as moſt of the Spaniſh ſilver mines.

Mr. Hooke read a farther diſcourſe of Padre Lana concerning flying, which he had tranſlated; and added to it a diſcourſe of the impoſſibility of that attempt by that means; and alſo ſhewed wherein the author had been greatly miſtaken in the grounds and ſuppoſitions of his demonſtration, viz. in ſuppoſing the ſame thickneſs of metal to be ſufficient to reſiſt the preſſure of the air inward in a ball of twenty-four feet diameter as in a ball of one foot diameter: whereas on the contrary it is neceſſary to increaſe the weight of the ſhell more than according to the proportion of the ſolidity or capacity of the ball.

Dr. Grew read a paper of his concerning moſt of the mineral waters about London.

Mr. John Wheeler was propoſed candidate by Sir John Hoskyns.

June 12. There being but a ſmall number of members preſent, the Society did not ſit, but were entertained with the examination of ſeveral experiments.

The firſt was the body of a mackarel boiled by Monſ. Papin after his new way; which being examined by ſeveral, it was found, that the fleſh was very ſolid, hard, and whole, and very well taſted, without any unuſual quality, except that all the bones of it were as ſoft almoſt as the fleſh itſelf.

The ſecond was a parcel of hartſhorn, which had been formerly ſoftened, and ſhewn to the Society, and kept ſince that time cloſe ſtopt in a glaſs. This being ſmelt, taſted and felt, ſeemed by all thoſe ſenſes to be old Chedder or Parmeſan cheeſe.

The third were the chips of oranges ſoftened by the ſame art, which were very whole, but made throughout very tender. This way of boiling was affirmed by Monſ. Papin to be very uſeful for making ſweet-meats.

The fourth was the tendril of a vine brought by Mr. Thomas Crispe; which being examined by Mr. Hooke with a microſcope was found to have a good number of ſmall plants ſeeming a kind of moſs growing on it; the ſtalks whereof were about half an inch long, and as fine as the hair of a man's head; at the end of each of which grew a pod much like that of ſeeding moſs, but very much ſmaller.

June 19. There being but few members present, and Sir ROBERT VINER and Sir ROBERT CLAYTON being there were entertained by those members with a sight of the repository, library, and weather-clock newly set up.

Monf. PAPIN shewed a new kind of wind-fountain of his own contrivance.

June 26. Sir CHRISTOPHER WREN, vice-president, in the chair.

The minutes of the 5th and 12th of June were read: whereupon occasion was given to discourse farther about the China-ink; which some supposed to be an inspissated juice; but Sir CHRISTOPHER WREN affirmed it to be only lamp-black very finely ground, and made up in cakes.

There was also a discourse about the way of softening bones by Monf. PAPIN: concerning which Sir CHRISTOPHER WREN queried, whether the way of softening them did not hint by a contrary process a way of hardening either the same or other bones not softened first. To which Monf. PAPIN gave no positive answer, having not yet discovered to the Society his way of doing that operation.

Mr. HOOKE produced an intire cocoa-nut, which was newly brought from Barbados; and he caused it to be cut in sunder, and poured out of the middle of it a glass full of liquor containing about a third part of a pint. This liquor was something whitish, and tasted sweetish and pleasant like an emulsion. It was contained in the cavity of the kernel, which might be capacious enough to hold about a pint. The kernel was about three fourths of an inch thick, lining the inside of the shell, which was about one eighth of an inch thick and very hard. The kernel was much of the same taste with the liquor, but pretty hard and tough.

Dr. CLENCH being introduced by Dr. TYSON addressed himself to the vice-president, and presented the Society with a certain root lately brought out of China, called ginsing, of great esteem in China for its virtue in restoring consumptive persons, and those emaciated with long sickness, to their former health and strength. It was valued in China at twice its weight in silver. It is shaped like a briony root, but is scarce so big as a skirret. It is white like a parsnip. Its taste is very bitter and somewhat hot upon the tongue somewhat like gentian, and seems upon the same account to be a very good stomachic.

Dr. CLENCH delivered in some of it for the repository wrapped up in Chinese paper, together with a paper containing an account of some of his trials and experiments made with it in England.

Dr. GREW read a paper of his observations made on several medicinal waters, viz. from Gilsit-spaw, Sunning-hill, and Willow bridge in Staffordshire; on a petrifying water from Oxfordshire; on sea-water from Sandwich; and on another kind of salt water from the Black Sea.

After

After the reading of this paper he shewed some of the salts exhausted, and amongst the rest the salt of the Euxine-Sea water, which being tasted was found to be a perfect caustic, and exceedingly different from any other kind of sea-salt.

Mr. HOOKE produced the breast-part of a new sort of armour made of silk well quilted together, which was able to resist the shot of a pistol or carbine. It was near three fourths of an inch thick, and very hard and pretty heavy. Whether it would perform what was pretended concerning it, the Society was not convinced by any experiment: only the gentleman, who owned it, shewed it with two bullets, which had been shot against it by the prince[a] in the king's presence, which were very much battered and flatted against it without at all penetrating it.

July 3. At a meeting of the COUNCIL were present

Mr. HENSHAW, vice-president,

Sir JOHN LOWTHER,	Mr. HILL,
Sir JOHN HOSKYNS,	Dr. GREW,
Mr. COLWALL,	Dr. MAPLETOFT,
Dr. CROUNE,	Mr. HOOKE.

It was ordered, that Mr. HOOKE shall have power to employ Mons. PAPIN for the writing of all such letters, as shall be ordered, to the correspondents of the Society: and that all such letters shall be transcribed into a Letter-book to be kept by the secretary of the Society: and that all the said letters, when fairly written, shall be shewn to such person of the Society, as the council shall appoint from time to time for viewing of them before they be sent to the correspondents, and after such perusal shall be sent by the secretary as directed: and that for so doing the said Mons. PAPIN shall receive from the treasurer of the Society the sum of eighteen pence per letter, unless the letter shall exceed two sides of a quarter of a sheet of paper; for every of which he shall receive two shillings, he producing his bill of the number of such letters signed and attested by the Secretary:

That the letters being approved of by any two of the council shall be sealed and sent as above:

That Mr. HILL the treasurer pay Dr. POPE ten pounds for one year's rent for the use of his lodgings as astronomy professor in Gresham-College, due February 23, 167$\frac{8}{9}$: And,

That Mr. HOOKE be desired to publish (as he hath now declared he is ready to do) a sheet or two every fortnight of such philosophical matters, as he shall meet with from his correspondents; not making use of any thing contained in the Register-books of the Society without the leave of the council and author.

At a meeting of the SOCIETY the same day, Mr. HENSHAW, vice-president, in the chair.

[a] RUPERT.

One of the copies of Mr. HEVELIUS's fecond part of his *Machina Cœleſtis*, containing the fecond, third, and fourth books, newly fent over by the author to feveral of his friends in England, was fhewn to the Society by Sir JONAS MOORE; in which were found Mr. HEVELIUS's celeftial obfervations for the fpace of forty-nine years.

Sir JONAS MOORE mentioned, that Mr. HALLEY defigned to vifit him in his return, and to take the latitude of that place.

The minutes of June 26th were read; which gave occafion of difcourfing farther about the mi k or liquor contained in the cocoa nut. Dr. GREW was of opinion, that all that milk would by degrees, as the fruit ripened, thicken into a kernel; and conceived farther, that the young plant lay in that, and not in the fubftance of the hollow kernel.

Mr. HOOKE was defired to examine PISO's natural hiftory, to fee, if any light touching this conjecture might be obtained.

It was farther related, that the palm-tree-wine was not this liquor of the cocoa nut, but the fap of a tree got out of the body of the palm, by boring a hole in the tree, and putting a tap into it, much after the manner that birch juice is procured.

Monf. PAPIN was introduced by Mr. HOOKE to fhew the Society fome farther trials, which he had made of his invention of boiling, upon tortoife-fhell and ivory. The firft was obferved to be very foft and pliable, but with a confiderable toughnefs, much like wetted tanned leather. The fecond had been boiled in ale or beer, and had thereby the parts of it extremely foftened, and remaining as it were loofe one upon another like rotten wood. He was defired to profecute fome farther trials in that way by boiling fome lobfters, oifters, prawns, &c. to fee whether they may be this way foftened.

Dr. GREW produced and read a paper of fome obfervations made by him on fome other waters in and about London.

Mr. HOOKE produced a packet of books, which were fent to him directed for the Society; which being opened were found to be fome catalogues of Dr. SWAMMERDAM's rarities, one of which was referved for the library, and the reft diftributed to feveral of the members.

There was fome difcourfe held concerning waters, whether thofe, that were impregnated with alcalizate falts, would draw tincture more plentifully than frefh water. Dr. GREW was of opinion, that they would: but Mr. HOOKE conceived, that frefh water would draw a much ftronger tincture from a plant before it was impregnated with falt than after; for which he alledged many reafons, and inftanced particularly in the way of drawing tinctures from fenna, the one with fair

water, the other with water impregnated with ſalt of tartar; the firſt of which would be the ſtrongeſt, though the other appeared deeper.

Dr. SLARE was introduced by Mr. HOOKE to ſhew the Society the experiments of animals *in ſemine animalium*. He brought with him the liquor, which he had lately expreſſed out of the teſticle of a ſtone-horſe, which had been newly gelt. This liquor he took up in ſmall canes, and viewed them with a ſingle microſcope, whereby they were made viſible: but Mr. HOOKE putting ſome of the liquor upon the plate of his double microſcope, an infinite number of thoſe ſmall wriggling creatures might very plainly be diſtinguiſhed, and were diſcovered and obſerved by moſt of the members, who were preſent.

July 10. Mr. HENSHAW, vice-preſident, in the chair.

Mr. LAMB's propoſals about two celeſtial hemiſpheres [c] were ſhewn; but when it was underſtood, that they were not rectified by the late obſervations of Mr. HEVELIUS, they were neglected as imperfect.

Mr. JOHN VALENTINE SCHOID of Straſburgh was preſent, and deſired to receive the commands of the Society, being ſoon to return home.

The minutes of July 3d were read, and Mr. HOOKE was deſired to examine PISO about the cocoa nut. Sir JONAS MOORE ſaid, that the Indians uſe to bore a hole in the palm-tree, and to roll up a leaf of the tree, and ſtick it into the hole for a ſpout for it to run by into a cup made of the ſhell of its own nut. They uſe to tap them in the morning before ſun-riſing.

Mr. HENSHAW obſerved, that the palm, that yields wine, is only in the Eaſt Indies, where they drink no other: and that the way uſed by the Indians for climbing up the palm-tree was by the help of a couple of ſhort ropes, the one tyed to their feet, the other about their arms, by the ſucceſſive ſliding up of which they will climb to the top of the ſmootheſt and ſtraiteſt tree.

Sir JOHN HOSKYNS remarked, that there was one palm in Guinea, the fruit whereof yielded a good quantity of oil uſed in thoſe countries inſtead of butter, though not ſo agreeable to the Europeans.

It was farther obſerved, that the wine of the palm will with keeping turn to very good vinegar, and being boiled preſently yields good ſugar, and being fermented makes a very good wine.

Monſ. PAPIN produced a piece of the tortoiſe ſhell, which he had ſhewn at the laſt meeting ſoft like wet tanned leather, now reduced to its former hardneſs and tranſparency, and retaining the poſture, which it had been put into, when

[c] See Mr. HOOKE's *Philoſophical Collections*, n° 1. p. 44.

ſoft.

foft. This, it was fuppofed, might be very ufeful for many mechanical works; and if the fame effect could be performed upon horn, it was thought, that it might be very acceptable to divers mechanics.

Upon this feveral difcourfes arofe about tanned leather; and Mr. HOOKE urged, that the tanning of leather confifted only in the drawing out of the glutinous part of the fkin, and the leaving the fibrous part; which was the reafon why fkins not well tanned being wet and dried again become ftiff and hard, the remaining gummous parts glewing the fibres together; whereas tanned leather being wet and dried again becomes limber and fupple as cloth, it having no gummous parts left. Whereupon divers difcourfes were occafioned about the feveral ways of tanning leather.

Sir JOHN HOSKYNS mentioned the way, that the Indians in Virginia and the northern parts of America ufe to drefs their fkins; which is by the means of the brain of the creature, which they kill, mixed with oil of walnuts called hickery nuts, and a wine made of oifter-fhells. With this they fmear over the raw fide of the fkin, and by help of the fire prefently drefs it with the hair on, that it equals, if not exceeds any way ufed in Europe.

Mr. HENSHAW conceived, that the Ruffian and Turkey way of tanning their leather was with the bark of the birch and the faw-duft of fir. He alfo faid, that they had a fort of wooden cups in Ruffia, which were as tough as leather, and might be turned infide outward without breaking: and that they have a fort of apples as tranfparent as a ripe white grape; fo that the core and kernels may be plainly perceived from without.

Monf. PAPIN produced a lobfter, which he had boiled after his new way, but the fhell thereof was not much foftened; but the body thereof yielded a confiderable quantity of liquor.

Mr. HOOKE read a tranflation, which he had made of a letter of Mr. LEEWENHOECK formerly read by Dr. GREW, in which the writer gave an account of his obfervations made on the feed of animals, as of fifhes, birds, and beafts, in all which, he affirms, that he had difcovered with his microfcopes vaft quantities of living creatures exceedingly fmall: to which he annexed a paper, in which he had calculated both the number of thefe animals in the milt of a cod fifh, and the number of men at one time upon the habitable face of the earth, and concludes, that the number of the former exceeds the latter at leaft ten times.

Dr. GREW fhewed fome draughts of the guts of fome creatures, which he had formerly diffected; of which he promifed to bring in an account, but he did not leave the draughts.

July 17. Sir JONAS MOORE, vice-prefident, in the chair.

Sir THEODORE DE VAUX prefented two books fent by the grand duke to the prefident

president and secretary of the Society by the hands of Signor TERERE, that prince's resident in England, being two copies of STEPHANO LORENZINI's *Osservationi interno alle torpedini*, printed at Florence in 1678.

These were recommended to Sir JOHN HOSKYNS and Mr. HOOKE to be perused by them, who were desired to give some account of the contents of that book at the next meeting.

Mr. POVEY inquired of Mr. FLAMSTEAD concerning the heat of Greenwich-Hill, who said, that it was temperate. Whence was occasioned some discourse concerning the heating of the air by the beams of the sun either direct or reflected; and it was argued, that the heat of the earth was one of the greatest causes of warming the air near the surface; whereas the air at the top of hills being much in motion, and farther removed from the surface of the earth, was not so much heated.

Mr. HOOKE gave an account of his having perused PISO about the cocoa nut, and related, that this author affirms the young cocoa nut to be full of a pleasant milky juice, but that when it is fully ripe, that juice is dried away, and there is only a hollow kernel left within the hard cocoa shell. Upon this occasion mention being made of the Indians climbing those palm-trees, Mr. HOOKE described the way of their doing it by the use of two short ropes, the one fastened to their feet, the other to their arms, by the help of which they could climb to the top of the straitest, smoothest, and highest trees.

Upon mentioning the Russia apple, that was transparent, Mr. HILL mentioned, that there is in England such an apple called the cucumber-apple, which is somewhat transparent in several of its parts and cells.

Mr. POVEY, upon the discourse of the cocoa wine, affirmed, that there was no sweet juice but what would turn to the sourest vinegar; and that the palm-tree wine would accordingly do so.

Upon reading the relation of the way of tanning of Russia leather Mr. POVEY proposed, that Mr. CHARLES HOWARD's experiment of tanning might be tried by the Society; and that he was willing to communicate to them; and he undertook to procure the way, and to bring it in.

Mr. HILL affirmed, that all the Russia leather brought into England was made of elk-hides. Thereupon a farther discourse was occasioned concerning the curious colour and lasting smell of Russia and Turkey leather, and a farther inquiry concerning the materials, with which it was tanned: and Mr. POVEY mentioned, that the cuttings of Russia leather being laid in a chest amongst clothes was an infallible way of preserving all within it from moths.

Sir THEODORE DE VAUX observed, that the lying on those skins was very good for

for ſuch, as were troubled with the ſtone. Others affirmed, that the lying on other leather would have much the ſame effect.

Sir JONAS MOORE related, that Mr. FLAMSTEAD had formerly given him a deſcription of the way and proceſs of making Derby malt, and promiſed to look it out, and bring it to the Society. He alſo added, that the people of that town had a way of cooling their ale very quickly, ſo as it blinketh it ſo, as they called it, that it grows clear and fit to drink preſently.

Several ways were mentioned of the clarifying of ale; the worſt of the ale-wives by putting a chamber-pot into it; another of a pewter-diſh, and another with a green oaken bough.

Mr. POVEY ſaid, that there was a way of making a very ſtrong and very pale ale with wheaten malt. Others remarked, that the ſame thing might be done with common malt by putting whole wheat into the ale.

Dr. GALE ſaid, that there was a way of making mulberry-ale or groot-ale preſently work, clarify, and be fit for drinking, by putting into it a kind of leven made of the yeaſt of empty caſks dried and made up into a ball: but that was not approved to be ſo pleaſant or ſo wholeſome.

Mr. POVEY promiſed to bring in a receipt of making very pleaſant, wholeſome and ſtrong ale, and as good as any.

Thereupon Sir THEODORE DE VAUX promiſed to bring in a dozen receipts, which had been experimented by Sir THEODORE MAYERNE for making of ales of ſeveral ſorts.

This occaſioned a diſcourſe about various ways of making wines and other pleaſant and wholeſome drinks of other ſorts.

Sir THEODORE DE VAUX promiſed to bring in the receipts of making divers of them, as with currants, water and ſugar, and with raiſins and water: and Mr. POVEY related, that the earl of Northumberland had made much uſe of this laſt wine; and that a diſtiller of Vaux-hall made ſpirits with ſuch wine. Others affirmed, that it was uſed alſo by ſeveral other diſtillers.

Hereupon much diſcourſe aroſe about making wine with cherries only, of which there is ſo great plenty in Kent and ſeveral other parts of England: and it was wiſhed, that that deſign might be promoted, ſince it would greatly ſave the expence of foreign wines, and much improve our own country.

Mr. EVELYN affirmed, that he had made wine with cherries, which kept very well two years; as alſo, that he had made an excellent drink of quinces.

Sir THEODORE DE VAUX mentioned a way of renewing and refreſhing palled and

and decayed wines by putting raisins in it. And Mr. HOOKE said, that he had known a merchant, who made use of the juice of English grapes to renew his wines.

Mr. POVEY promised to give an account of the goosberry wine, which he had lately made.

Mr. EVELYN promised to communicate some of his ways of making cherry and some other English wines.

Dr. GREW was called upon to bring in his paper about the guts, which he had shewn at the former meeting.

Sir THEODORE DE VAUX related, that there was lately found at Acton a water, which was twice or thrice as strong as Epsom water, being very bitter.

Dr. KING said, that upon evaporating it, he had found above double the quantity of salt in it, that he had found in Epsom water.

He added, that it was an ill custom to put common salt into such waters to make them purge.

Dr. GALE observed, that it was an antient way used by physicians in Egypt and Greece.

Mr. HOOKE shewed two experiments: the first was the testicle of a lamb, which being dissolved, and the liquor contained in it examined in a microscope, it was found not to have any live animals, but to be exceedingly full of the small globules. Whether there had been any creatures in it, and were now dead, by reason that the lamb had been killed in the morning; or whether there were not as yet any living creatures in it, the lamb being not come to maturity for generation, could not be distinguished. But farther trial in order to this inquiry was desired to be made on a young lamb's stone, as soon as the creature should be killed.

The second experiment of Mr. HOOKE was with the exhausting engine of Monf. PAPIN: and that was with a long helical spring of brass-wire extended by a weight hung at the lower end of it, the upper end of the same being fastened to the top of a long glass cone. Out of this cone the air was well exhausted, and the station and length of the spring was curiously observed: then the air was let in, and the same observations were made with the same cone; and it was found, that the whole pressure of the air did not in the least alter the stiffness of the spring; which cleared that dispute, whether the unequal motion of a watch does not proceed from the alteration made on the spring by the various pressure of the air thereupon.

Monf. PAPIN shewed his way of exhausting small glasses for preserving * * and

keeping them tight by the help of a looking-glaſs-plate ground true upon the edge of the glaſs.

July 24. Sir JONAS MOORE, vice-preſident, in the chair.

The minutes of July 17th were read; whereupon Sir JOHN HOSKYNS was deſired to give the Society an account of the Italian book of LORENZINI on the torpedo; which he had undertaken to peruſe; and accordingly he gave the following account of it:

That the book was full of curious and new obſervations: that the author had very minutely and particularly deſcribed the torpedo and its parts: that it is of the ſort of the flat cartilaginous fiſhes: that there are two ſorts of it, a greater and a leſſer: that he had ſeen of the greater weighing twenty-five pounds, and of the leſs not above ſix ounces: that in the ſkin are ſeveral pores, which are the ends of double ductus's to bring ſlime to the ſkin to make it ſlippery: that one of theſe ductus's comes from the head, the other from the ſides of the back: that the brain touches the pia mater in the baſe only, being ſeparated elſewhere by water, in which it ſwims: that the heart has but one ventricle, and continues to move nine or ten hours after it is cut out, as the parts of the body, when ſeparated, will in four or five hours: that its ovarium is near the liver and double oviduct and womb, wherein the young ones ſwim free, and have no communication with the womb; the author by the by deſcribing the genitals of a lobſter and ſome other fiſhes, and ſhewing ſome errors of Dr. WILLIS: that the benumming quality is ſeated in two ſemicircular muſcles on each ſide of the thorax, conſiſting of fibres about the bigneſs of a gooſe-quill made up of bladders filled with a liquor, and they end in the back and belly: when the hand touches theſe, the fiſh contracts them, and ſqueezes out the liquor, which enters the ſkin at the fingers-ends, and cauſes the numbneſs like that of the elbow hit againſt a hard body; but the numbneſs and pain vaniſh in a ſhort time: that nothing but immediate contact will produce this effect: that this fiſh, as moſt others, has properly no tongue: that the ſtomach and guts are ſhort and large with few fibres, but abound with a copious diſſolvent, that conſumes the fiſh, which it ſwallows alive, into a chyle: that the fiſh takes in water by ſeveral holes near the ſtomach, and throws it out at the other end, waſhing in its way the bronchia: that the author often recommends experimental philoſophy and comparative anatomy.

Dr. CROUNE queried, whether the author had ſaid, that this benumming liquor is any colder than the reſt of the body: to which Sir JOHN HOSKYNS anſwered in the negative.

Mr. HILL related, that Mr. TORRIANO lately drinking the waters at Epſom found, that they paſſed well the three firſt days, but did not the fourth and fifth. Whereupon he ſoon after died, and being opened, his guts were found gangrened.

Monſ.

Monf. Papin promifed to communicate at the next meeting a method of keeping large veffels exhaufted with eafe, in order to boiling and diftillation.

Mr. Haak produced a book intitled *Propofitions of Optic Glaffes*, printed at the theatre at Oxford.

Mr. Hooke, who had read fomewhat of the book faid, that he had not found any thing in it, which was new; and that it contained fome propofitions about the place of the image, which were not true: that it came far fhort of the theory of optics now well known, which he conceived to have been firft well underftood by Kepler, and highly improved by Des Cartes.

Mr. Hooke read a long paper, which he had tranflated from the French, giving an account of the prodigious overflowing of a river in Gafcoigne, written by a perfon, who had made it his bufinefs to inquire into the truth of the fact, and had likewife been inquifitive after the caufe, which he explained and illuftrated by divers very convincing circumftances, afcribing it to the * * * * of fome of the Pyrenean mountains into the fubterraneous cifterns within the bowels of them [d].

This occafioned a difcourfe of the effects of the like nature; and Sir Jonas Moore and Mr. Hooke mentioned fome, that had happened at Pendel-Hill, of which an account had been given in a letter read to the Society.

Dr. Gale added, that there were many inftances of the like nature in the mountains of the north, where gufhings out of the water from the hills made great gills, as they were called; that is, channels in the fides of them, out of which the water gufhes from the mountain.

Dr. Croune read a letter from Mr. Hevelius in anfwer to that, which he had written to him, and fent by Mr. Halley; wherein Mr. Hevelius teftified his refpect for the Society, and his efteem of Mr. Halley.

Sir Jonas Moore read a letter from Mr. Halley, giving a farther account of his reception and entertainment in aftronomical matters by Mr. Hevelius.

Mr. Hooke was defired to get the Italian book [e] tranflated into Englifh, and printed; which he promifed to endeavour to do.

Upon the difcourfing of optics Sir Jonas Moore having faid, that he had a piece of Mr. Gossignees in a Latin manufcript on optics, as alfo divers papers of Mr. Gascoigne's on the fame fubject, he was much defired to procure them to be printed; Mr. Hooke, who had fome years fince feen that tract of in Mr. Collins's hands, judging it to be very good and fit for publication.

July 31. Mr. Henshaw, vice-prefident, in the chair.

[d] This account is printed in Mr. Hooke's *Philofophical Collections*, n° 1. p. 9.

[e] Probably that of Lorenzini on the torpedo.

The minutes of the 24th instant were read, which gave occasion for some additional observations, viz.

Sir JOHN HOSKYNS observed, that Signor MALPIGHI had observed, that the reason of the mobility of the parts of insects, after they are cut asunder, is from the brain and medulla spinalis.

Mr. HENSHAW conceived, that it might be partly from that, and partly from the sliminess and toughness of the juice, in which the spirits moved in these creatures, which were observed to move after they were cut to pieces, this juice keeping the spirits, without suffering them presently to evaporate.

Sir JOHN HOSKYNS conceived, that devouring animals knowing where to fasten on their prey so as to kill them immediately (as had been observed of a lyon griping a lamb and a dog to death at one bite) fishes likewise may have that instinct to bite the torpedo to the heart: whence nature seems to have furnished that part with the preventive, viz. the benumming quality, whereby, as it is supposed, the preying fish becomes immediately benummed, and the torpedo escapes.

Mr. HILL mentioned a person, who passing over a field in a very cold day found himself as it were stricken on one side of the belly by a cold blast with much pain; which pain continuing for two days killed him. Upon opening his belly it was found gangrened in that place. This kind of cold is called by the country-people the cold fire, and is very usual in Russia and other cold countries.

Sir JOHN HOSKYNS added, that CARPENTER[f] in his *Geography* had made mention of just such an eruption of water out of the hills, as that in Gascoigne mentioned at the last meeting; as also of subterraneous fish.

Mr. POVEY presented to the Society for their repository from Mr. JOHN SHORT the draper the head of a turtle very large, the mouth of a shark, the heart of a tortoise, the nether part of an Indian crow's bill, the *piscis quadrangularis*, the tusk of a boar, a part of an Indian lo** in shape like that of the acacia.

Mr. HOOKE read a discourse of his concerning the use, which he had found of convex glasses for helping short-sighted people to see objects at any distance very distinct and bigger than any one, which the naked eye can distinguish; which is a discovery of much benefit to short-sighted persons[g]. He called his discovery *myopibus juvamen*, and observed, that by the use of seeing things inverted it became as natural as if they were seen erect; and he conceived, that if a person from his childhood were used to see things by this means inverted as we call them, though they were really erect in the eye, if they should afterwards come to see them without the help of these glasses, they would conceive, that they saw

[f] NATHANIEL CARPENTER, D. D. fellow of Exeter-College in Oxford, and afterwards schoolmaster of the king's wards in Dublin. He died there in 1628.

[g] This discourse is published in Mr. HOOKE's *Philosophical Collection*, n° 3. p. 59.

them

them inverted, as they really are, at the bottom of the eye, as he said was very visible in a young cat's eye, which is almost transparent at the bottom.

Mr. COLWALL gave an account from Mr. FLAMSTEAD, that he had prosecuted the observation begun and invented by Mr. HOOKE of observing the parallax of the earth's orb among the first stars by a perpendicular telescope; and that he had certainly found what it is. It was hereupon moved, that Mr. HOOKE should desire the observation of Sir JONAS MOORE, and insert it in the next *Transaction*.

Monf. PAPIN produced an instrument, by which he could boil any thing *in vacuo*; and shewed the manner of exhausting with his engine, and how he preserved it from leaking, whilst it boiled, by tin and screws, &c.

Mr. HOOKE produced and examined the testicles of a cock just killed, but could not perceive any of those small animals in its seed, that had been seen in that of a stone-horse. It was conceived, that the reason was, because the cock was very young, and possibly not fit for generation.

August 7. At a meeting of the COUNCIL were present,

Mr. HENSHAW, vice-president,

Sir JOHN HOSKYNS,	Dr. BROWN,
Mr. COLWALL,	Dr. GREW,
Dr. GALE,	Mr. HOOKE.
Mr. HILL,	

It was ordered and desired, that Mr. HOOKE do, as soon as may be, print a relation of all the experiments, observations, and relations made and brought into the Society by himself since his first coming into it; and that he have leave to take his own method in the doing thereof.

It was left to him to print the *Transactions*, which he designed to publish, either once a month or once in a fortnight, or oftener.

It was ordered, that Mr. HOOKE shall proceed with the correspondence, and send away such letters, as are already written; and likewise take care to defray the charge of postage both outwards and inwards:

That Sir JOHN HOSKYNS, Sir JONAS MOORE, Mr. COLWALL, Mr. HILL, Dr. GALE, Dr. BROWN, Dr. GREW, Dr. MAPLETOFT, or any three of the council, do meet together, and go to Mr. CHENEY to discourse with him concerning Chelsea-College: and that in the mean time Sir JOHN HOSKYNS be desired to inform himself as fully as may be concerning the title of the Society to Chelsea-College; and in order thereunto get copies of such records, as he conceives necessary and are wanting: and that they meet at Mr. COLWALL's house on Tower-hill on the Wednesday following at three in the afternoon precisely:

That all papers, that for the future shall be brought into the Society to be read, be returned to the person, who brings them, if he desires the same: And,

That the following bills be paid,

	l.	s.	d.
A bill of Dr. Grew for seven lectures - - - - - -	9	0	6
A bill of Mr. Martyn for lists, tickets, &c. - - -	5	4	0
A bill of Mr. Wicks for expences ending at Christmass 1678 - -	5	5	0
A bill of Mr. Wicks ending May 29, 1679, for writing, &c. - -	16	0	0
Mr Wicks's salary for 1 $\frac{1}{2}$ year ending midsummer 1679 - -	15	0	0
The stationer's bill to July 4, 1679, - - - - - -	6	16	0

At a meeting of the Society on the same day, Mr. Henshaw, vice-president, in the chair.

The minutes of the 31st of July were read . whereupon there was a farther discourse about short-sighted persons, and of the ways of vision, from the assertion of Mr. Hooke, that a man used to see things always inverted would in time judge, that he saw them as they are Dr. Croune queried, whence it should come, that the conception should imagine that object erect, which is represented at the bottom of the eye inverted. Dr. Grew supposed, that it might proceed from the of the optic nerves, which might cause a second inversion. Mr. Hooke thought, that this could not be the cause, since it was not general in all creatures, and he conceived, that the inversion of the optic nerve was in none observable: but that it rather proceeded from the mind's making comparison of the sensation by the eye with the sensation made by the touch: or rather, that it is an idea or the rule of sight implanted in the soul by nature.

Mr. Henshaw mentioned the explanation given of it by Des Cartes, who compares the sight to the feeling of an object by the medium of a staff.

Mr. Hill mentioned, that a maid, who was blind from her infancy, and never saw any thing till Mr. Stepkins cured her, upon the first recovering of her sight, looked on the sun, and thought, that she could have reached it: whence it was inferred, that the mind judged of distances partly by circumstances.

Mr. Henshaw observed, that the sun in Norway very often rose and set in an oval figure. Mr. Hooke affirmed, that it was likewise so here for the most part; which was caused by the refraction or rather inflection of the air, as he had elsewhere shewn.

Sir John Hoskyns remarked, that looking at the sun or stars through a small hole made in paper caused them to appear less than to the naked eye.

Dr. Croune gave the reason of the sun's appearing bigger near the horizon from the dilating of the pupil; for that according as the pupil is dilated, the object appears bigger or less.

Mr,

Mr. HOOKE affirmed, that if you look through a hole an hundred times less than the pupil, the object will appear the same that it does to the naked eye, when it sees it distinctly: but in objects too strong for the eye, it helps the eye by debilitating the rays, which otherwise make a false representation.

Mr. HENSHAW was of opinion, that the refraction of the air might cause the sun to appear bigger; and that the vapours also might augment it. Dr. CROUNE was also of the same opinion, that the vapours might augment it rather than the refraction, because the air consists of parts very different from the æther. In favour of Mr. HENSHAW's conjecture, Sir JOHN HOSKYNS affirmed, that at noon-day the sun would appear much bigger, when seen through a very thick fog, which fog he conjectured was nothing else but an infinite number of exceedingly small drops.

Mr. HOOKE conceived, that the object, as the sun, moon, &c. in all probability appeared under the same angle to the eye; but that the judgment or fancy imagined it to appear bigger or less according to the distance, at which it conceived it to appear: and therefore those luminaries are usually conceived bigger, because they are seen to be farther off than the objects nearer of known magnitude: that the refraction is so far from augmenting them, that it rather diminishes them; for should the whole horizon be raised to the Zenith, it must appear a point, and always the less, the more it is elevated upward, by reason of the contract of the Azimuth: that the imaginary bigness of a sun through a fog arises from the opacity of the air, which is always * * with objects seen at a great distance, or through a great body of air; and by this landscape painters deceive the eye, and make it imagine, that it sees things at a distance, because they are painted with faintish blueness: for a man seen in a fog appears of a gigantic bulk; because, though he be very near, yet being seen through a thick air, the fancy imagines him at a much greater distance.

Monf. PAPIN shewed his experiment of the quantity of the air compressed in his wind-gun; but the vessel being somewhat too little, it could not be certainly measured, but was found to hold about fifty times the quantity of air, which it held before condensation.

The Society adjourned for the ensuing vacation, not to meet again till summons given; but such members as pleased to meet to discourse in the mean time, might do so at the repository or library on Thursdays in the afternoon, where there would be some entertainment for them. Accordingly on the 14th of August, 1679, some of them met, when the body of a child, which had been twenty-six years in its mother's belly, and was supposed to have been alive for the space of twenty of them, was exhibited, together with attestations of the truth of the relation, which was published in one of the monthly *Transactions*.

The members present, upon viewing the same, and taking notice of the remarkable particulars, judged it to be a very rare and wonderful production.

Mr.

Monſ. PAPIN made a farther trial with his wind-gun, and the glaſs recipient being now big enough, it was found, that the receptacle thereof, when charged with air ſo much as he was able to throw into it by his own ſtrength, contained ſixty-four times as much air as it did before it was charged.

September 22. At a meeting of the COUNCIL were preſent

Sir CHRISTOPHER WREN, vice-preſident,

Sir JOHN HOSKYNS,	Dr. GREW,
Mr. COLWALL,	Dr. BROWN,
Dr. GALE,	Mr. HOOKE.
Dr. ALLEN,	

Upon debate about printing the next *Tranſaction* it was thought fit, that if Mr. MARTYN ſhould refuſe to print the ſame as uſually, the council ſhould be acquainted with it at the next meeting, to conſider of ſome other means of doing it.

Mr. HOOKE mentioning, that Monſ. PAPIN was ſuddenly going for Paris, and therefore deſired, that in conſideration of the time, which he had ſpent in entertaining the Society at their meetings, and in writing letters, he might be conſidered; it was ordered, that the treaſurer ſhould preſent him with five guineas; and that if Mr. HILL the treaſurer ſhould not return before Monſ. PAPIN's departure, Mr. HOOKE ſhould pay that money to Monſ. PAPIN, and receive it from the treaſurer.

It was farther ordered, that Mr. HOOKE ſhould propoſe to Monſ. PAPIN in the name of the Society twenty pounds a year certain; and that if there could be found a convenient lodging for him in Greſham-College, he ſhould be allowed it gratis; and that the Society would farther ſtudy to aſſiſt him:

That Sir CHRISTOPHER WREN, Sir JOHN HOSKYNS, Mr. COLWALL, Mr. HILL, and Mr. HOOKE do, as ſoon as poſſible, go to Mr. CHENEY, and view and take poſſeſſion of ſuch lands, as belong to the Society now lying about Chelſea; and that they give notice to the ſeveral tenants of the ſaid lands of ſuch their doings:

That Mr. HUNT take care to have all the inſtruments of the Society now in the cuſtody of Mr. FLAMSTEAD at Greenwich immediately removed to Greſham-College; and that Sir CHRISTROPHER WREN and Mr. HOOKE be deſired to go thither, and take what care they can in it; and that in the mean time Mr. HOOKE write to Mr. MOORE about the ſame, and deſire to have them carefully ſent home; and that the committee meet about this affair on the Friday following:

That Dr. GALE have the uſe of the manuſcript of the life of THOMAS BECKET for three weeks, he giving a note for the ſecure return thereof according to the orders of council made for that purpoſe: And,

That

That the treasurer do pay to Mr. HOOKE five pounds for the salary of Mr. CRAWLEY for the last quarter ending the 18th of this month; and that the said Mr. CRAWLEY be continued in the employment of the Society till the next meeting, when it was to be farther discoursed of.

September 29. At a meeting of the COUNCIL at Sir CHRISTOPHER WREN's were present

Sir CHRISTOPHER WREN, vice-president,

Sir JOHN HOSKYNS,	Mr. COLWALL,
Mr. HAAK,	Mr. HILL,
Dr. GREW,	Mr. HOOKE.

It was ordered, that Sir CHRISTOPHER WREN be desired to make the following proposals to Monf. FOUBERT concerning Chelsea-College, and to give an account thereof to the next meeting of the council, viz.

That the accommodations desired shall be provided by Lady-day following:

That the lease shall be made for twenty-one years, the first rent to be paid at Michaelmass, 1680, for half a year:

That the College and six acres belonging to it shall be valued at forty pounds *per annum*:

That the tenant shall pay ten pounds per cent. for the charge of fitting it over and above the said forty pounds *per annum*: and either pay in five hundred pounds (for which fifty pounds *per annum* shall be allowed him) or give good security for the rent.

September 30. At a meeting of the COUNCIL at Gresham-College were present

Sir CHRISTOPHER WREN, vice-president,

Sir JOHN HOSKYNS,	Mr. HILL,
Mr. COLWALL,	Mr. HOOKE.

It was ordered, that Mr. PERRY[a] forthwith speak with Mr. EVERARD, executor of GEORGE ENT, Esq; lately deceased, concerning the books left by the said Mr. ENT to the Society, and take care to have the said books removed to Gresham-College with all convenient speed: and that Mr. PERRY's receit shall be a sufficient discharge.

Mr. HOOKE reporting, that upon his making the proposal of the council of the 22d instant to Monf. PAPIN of twenty pounds a year certain for writing all letters for the Society, he had accepted the same, it was well approved of: but it

[a] Library-keeper to the Royal Society.

was farther thought fit, that articles should be drawn up to express the conditions expected by the Society to be performed by him, and to be subscribed by him.

October 10. At a meeting of the COUNCIL were present

Sir CHRISTOPHER WREN, vice-president,
Sir JOHN HOSKYNS, Mr. HILL,
Dr. GALE, Mr. HAAK,
Mr. HENSHAW, Mr. HOOKE.

Upon debating the proposals made by Mr. FAUBERT concerning Chelsea-College, it was thought fit and ordered, that the house and the five acres, whereon Chelsea-College stands, shall be let by lease for forty-one years to such persons, as shall be ready and engage to deposite the sum of money required, at the annual rent of thirty pounds: and that Mr. FAUBERT be made acquainted therewith.

Mr. FAUBERT being in the next room was called in, and acquainted with these proposals, who readily concurred with them: and it was desired, that care should be forthwith taken to make this conveyance from the Society; and that Sir JOHN HOSKYNS would be pleased to consult with * * council to that purpose.

It was farther ordered, that a letter should be sent to the president to acquaint him with this proceeding, and to desire his concurrence and assistance.

It was farther desired, that * * * endeavour to find among their acquaintance some persons, who may advance the sum of money requisite to complete the work according as it should be desired.

November 11. At a meeting of the COUNCIL were present

Sir CHRISROPHER WREN, vice-president,
Mr. HILL, Mr. EVELYN,
Mr. COLWALL, Mr. CREED,
Dr. ALLEN, Mr. HOOKE.
Mr. HENSHAW,

Mr. HOOKE was desired to find a fit collector for the arrears due to the Society: And,

To get a paper fairly drawn of Mr. FAUBERT's design.

Mr. EVELYN was desired to draw up a letter to be sent to such persons as were much in arrears to the Society.

November 20. At a meeting of the COUNCIL were present

Sir

Sir CHRISTOPHER WREN, vice-president,

Sir JOHN HOSKYNS, Mr. HENSHAW,
Mr. HILL, Dr. ALLEN,
Mr. COLWALL, Mr. HOOKE.

Sir CHRISTOPHER WREN read a letter drawn by himself to be sent to such person in arrears to the Society as shall be agreed upon by the council.

Mr. HOOKE was desired to inquire after Mr. ROBERT REYNOLDS.

Sir CHRISTOPHER WREN, Mr. HENSHAW, Sir JOHN HOSKYNS, Dr. CROUNE, and Mr. HOOKE were nominated a committee to audit the treasurer's accounts.

It was ordered, that the treasurer pay to Mr. HOOKE the last quarter's salary ending at Michaelmas past.

At a meeting of the SOCIETY on the same day, Mr. HENSHAW, vice-president, in the chair.

The minutes of the last meeting of August 7th were read; which gave occasion of farther discourse about sensation and sight, and was concluded, that sensation was performed by the help of the medium; and that the eye judged of the place of the object only by the impression made on the eye by the end of the rays, which immediately touched the eye; and that the imagination always conceived those rays to proceed in a direct line to the objects, and was not sensible of any refraction or reflection of those rays without some other help to inform the judgment: that direct * * was much of the same nature with the feeling of different substances by the help of a stick, which is strait; and so the blind man distinguishes the nature and position of those things, which he touches with his stick by means of his hand; which directs and holds the stick fast, so that any thing, that moves the end of the stick, moves also his hand: That the refracted or reflected ray is imitated by a stick variously bent, whereby the blind man not knowing of it supposes the substances touched by the end of it to be there, where that part of the end of his stick held in his hand directly points.

Mr. FLAMSTEAD related, that he had observed the refraction to be a whole minute at the hight of forty-five degrees; and that it was very considerable also at the hight of sixty degrees.

Dr. CROUNE took notice, that it was a desirable thing to have the barometer observed in several places, since it sometimes varied very much in a small distance of places: to confirm which he alledged, that by comparing the observations made at Paris with those, which he had made in London, he had found them sometimes to differ very much.

Mr. FLAMSTEAD conceived, that the barometer was only altered by the wind.

Mr. HENSHAW was of opinion, that this alteration proceeded from the vapours in the air; and that the greateſt part of thoſe vapours were brought from between the tropics into theſe northern parts.

It was deſired, that Mr. HOOKE ſhould write to profeſſor STURMIUS at Altorf to requeſt him to keep an account there of the variations of the barometer; which Mr. HOOKE promiſed to do.

Mr. FLAMSTEAD affirmed, that he had compared the obſervations of Mr. TOWNLEY with his own, and found them much the ſame, and to differ very little.

It was obſerved, that the laſt rains were general throughout all Europe; and therefore it was conceived, that the alterations of the barometer extended likewiſe very far, and were almoſt univerſal.

Dr. CROUNE took notice, that the great thunder in * * extended alſo very far, though thunder often extends but a little way.

Mr. HOOKE gave an account of the trial, that had been made with Monſ. PAPIN's wind-gun for condenſing the air to a ſixty-fourth part of the ſpace, which it filled before compreſſion. It was deſired by the Society, that this experiment might be repeated at the next meeting.

HENRY PAMAN, M. D.[i] was propoſed candidate by Dr. CROUNE.

November 27. At a meeting of the COUNCIL were preſent

Sir CHRISTOPHER WREN, vice-preſident,

Sir JOHN HOSKYNS,	Dr. GREW,
Mr. HENSHAW,	Mr. CREED,
Dr. GALE,	Mr. HILL,
Dr. BROWNE,	Mr. HOOKE.

It was ordered, that Sir CHRISTOPHER WREN be deſired to perfect the letter, which he had drawn up to be ſent to the members much in arrear; and that the copies of the ſaid letter be made to be ſent: And,

That Mr. PERRY be deſired to print his catalogue of the Norfolk library with an epiſtle to the Society making mention of the bounty of the duke of Norfolk[k].

At a meeting of the SOCIETY on the ſame day, Sir CHRISTOPHER WREN, vice-preſident, in the chair.

[i] He had been choſen profeſſor of phyſic in Greſham-college, 21 June, 1679, upon the reſignation of Dr. MAPLETOFT.

[k] This catalogue was printed in 1681, in 4to. at London.

The minutes of November 20th were read: whereupon it was farther debated, whence the alteration of the gravity of the air proceeds, whether from the greater hight of the air by a new influx of air from ſome other part of the world, whereby the perpendicular altitude was increaſed or diminiſhed, and conſequently the preſſure; or from the new acceſſion of ſteams, fumes, or ſaline ſubſtances, diſſolved and taken up by the air, in the manner of aquafortis taking up into itſelf ſilver, copper, iron, &c. and ſo is made heavier in ſpecie than it was before it was ſo impregnated: and thus, though it were not increaſed in bulk or hight, yet it might be increaſed in gravitation or preſſure.

Mr. Hooke was of opinion, that both theſe cauſes may concur to produce this effect; and that in order to the examination thereof he had contrived two kinds of barometers, which were firſt mentioned to the Society, as he conceived, about the year 1662, and lately alſo, viz. the laſt year. The firſt of which ſhould only ſhew the variations of the preſſure of the air cauſed by the alteration of the preſſure of the air from either or both cauſes: but the ſecond ſhould only ſhew the alteration of the preſſure of the air from the alteration of the ſpecific gravity.

Sir Christopher Wren was of opinion, that it proceeded moſt of all from the impregnating of the air by nitrous ſalts, which were continually raiſed up into it.

Dr. Croune mentioned, that Dr. Grew had formerly communicated an account of the ſolutions of ſalts by water, which would ſerve to explain this notion; which he conceived it would be proper to conſult.

Mr. Hooke alledged, that he had about eight years before ſhewn the Society at Arundel-houſe an experiment to prove the penetration of liquors one into another by putting oil of vitriol into water in a bolt-head of glaſs; whereby it manifeſtly appeared, that thoſe two liquors put together took up much leſs room than when they were ſeparated.

Dr. Croune was of opinion, that the air or water impregnated with ſalts become only heavier upon the account, that they were kept floating together, and a compound of water with an heavier body, as ſalt, the compound taking up as much room as the ſame bodies did apart: and there was no certain obſervation yet to the contrary of that in thoſe bodies; the compound body not weighing heavier than either of the compounding bodies.

Mr. Hooke alledged, that there were ſome inſtances, whereby it appeared, that bodies really penetrated into the texture of each other, and both together took up leſs room than they did before they were mixed, and ſo made a body, that was not only as heavy as it ought to be, ſuppoſing theſe bodies mixed together, but a body heavier than either of them; and conſequently there muſt be a penetration of the texture or dimenſions of each other. He alledged alſo, that there is the like penetration in oil of vitriol and water; and alſo in divers other bodies, which he could

could make evident. It was desired, that an experiment of this kind should be shewn at the next meeting.

Monf. PAPIN produced his wind-gun charged with air, which he designed by a pipe fastened into it to discharge into a large glass filled with water, and inverted into a bucket of water. But upon making the experiment, the pipe being too much pressed by the mouth of the glass, was cracked, and consequently much of the air went not into the said glass; and therefore the certainty of the experiment could not be now examined; but it was desired, that it might be shewn at the next meeting. But Monf. PAPIN having charged it again, shot a plug through an inch board at * * yards distance.

December 1. The Society met upon summons, in order to make their anniversary election of the council and officers for the year ensuing.

Sir CHRISTOPHER WREN, vice-president, took the chair, the president being absent on account of indisposition.

A sufficient number of members being present, the candidates, who had been formerly proposed, were put to the scrutiny by ballot, and these following were elected;

Mr. EDWARD TYSON,

HENRY PAMAN, M. D.

WILLIAM NAPPER, Esq;

Signor GIOVANNI AMBROSIO SAROTTI, son of the Venetian resident, who was proposed candidate by Mr. BOYLE.

Then the Society proceeded to their election, according to their usual manner, and the suffrages being collected, it was found, that the following members were continued of the council,

Sir JOSEPH WILLIAMSON,
Dr. ALLEN,
Mr. COLWALL,
Dr. CROUNE,
Dr. GALE,
Dr. GREW,
Mr. HENSHAW,
Mr. HILL,
Sir JOHN HOSKYNS,
Mr. HOOKE,
Sir CHRISTOPHER WREN.

The new members chosen into the council were,

GEORGE earl of Berkley,
THOMAS BARRINGTON, Esq;
Mr. EVELYN,
Dr. HOLDER,
EDMUND KING, M. D.
PHILIP PARKER, Esq;
Mr. WILLIAM PERRY,
Sir WILLIAM PETTY,
THOMAS POVEY, Esq;
Sir ROBERT SOUTHWELL.

The

The Society then made their election of officers, viz.

Sir Joseph Williamson, president,
Mr. Hill, treasurer,
Dr. Gale, } Secretaries.
Mr. Hooke, }

The earl of Berkley, Mr. Evelyn, Dr. Holder, Dr. King, Mr. Parker, and Sir Robert Southwell were sworn of the council before the vice-president, Sir Christopher Wren, according to the direction of the charter.

December 4. Before the meeting of the Society five of the council, viz. Mr. Henshaw, Mr. Hill, Sir John Hoskyns, Sir John Lowther, and Mr. Hooke viewed the gallery, and appointed Mr. Hunt to set up a partition for the library at the west end next the door, to inclose it for a library.

Mr. Henshaw, vice-president, took the chair.

William Bridgeman, Esq; was proposed candidate by Mr. Henshaw. Signor Sarotti was admitted fellow.

The experiment proposed at the last meeting by Mr. Hooke, to shew, that copper and tin being melted together into one mass, would make a composition extremely different from them both, was tryed and examined; and it was found, that equal parts of copper and tin melted together made a metal, which was exceedingly hard and very brittle, though the ingredients are both very soft and very malleable: and whereas copper is of a very brown red colour, this was extremely white, and, which was the principal property that it had newly acquired, the specific gravity of it was found to exceed those of both copper and tin; for whereas copper to water is as $8\frac{1}{3}$ to 1, and tin to water as $6\frac{4}{5}$ to 1, and thence the composition ought to have been to water as $7\frac{17}{30}$ to 1; it was found by weighing a part of this substance first in the air and then in the water, that the weight thereof to water was as $8\frac{198}{266}$, or $8\frac{3}{4}$ to 1; for it weighed in the air 2326 grains, and in the water 2060 grains.

Hereupon the cause of this was explained by Mr. Hooke, and ascribed to the penetration, which those bodies made into one another; and it was illustrated by the experiment, that had been formerly produced before the Society, of the mixtures of water and oil of sulphur or vitriol.

These experiments were made in order to illustrate some theories about the pressure of the atmosphere, to shew how the air might be impregnated with other bodies; whereby the specific gravity thereof might be augmented and altered, the hight thereof remaining the same.

Mr. Flamstead was of opinion, that the levity of the air proceeds only from the motion of the air, and the gravity thereof from its standing still; and that the

the same body moved does not press so much, as when it stands still: upon which several things were debated.

Mr. HOOKE alledged several observations made by him, which were contrary to that supposition; for he had found, that after a long and still rain, during all which the mercury had continued to fall, as soon as the air began to move, or the wind to blow, the mercury began to ascend. It is true, that it often happens, that in great winds the mercury is very low: and so it is likewise when there is no wind at all stirring, as in great rains: and it is no new observation, that in stormy weather the air is light, the barometers being all so marked.

The minutes of November 27, and December 1, were read, and some matters thereof debated.

Mr. HENSHAW alledged, that antimony by calcining would increase in weight; and mentioned, that Mr. BOYLE had found the same thing. It was therefore supposed, that the gravity of the composition of the tin and copper might be caused by addition to it from the fire.

Mr. HOOKE alledged, that the composition did not weigh heavier than the two ingredients joined together; but rather that it weighed lighter than the ingredients together did before the melting, by reason, that some part of each of them was wasted by the heat; but that the specific gravity of the composition exceeded the specific gravity of the two joined together as one compound gravity; and not only so, but likewise the specific gravity of the heaviest of them. Besides which he urged, that he had several times calcined antimony by the help of a burning-glass; and had always found it to grow considerably lighter by such calcination.

Upon discourse concerning foreign correspondence, it was moved, and the Society desired Mr. EVELYN, that he would endeavour to obtain from the secretaries of state, that the Society might have the favour to send to, and receive their letters from their foreign correspondents in the packet of the said secretaries, as they formerly had in the time of Sir JOSEPH WILLIAMSON's being secretary of state, which Mr. EVELYN engaged to endeavour.

Mr. HOOKE produced and read a letter of Mr. NEWTON to himself, dated 28th November, 1679, containing his sentiments of Monf. MALLEMONT's new hypothesis of the heavens; and also suggesting an experiment, whereby to try, whether the earth moves with a diurnal motion or not, viz. by the falling of a body from a considerable hight, which, he alledged, must fall to the eastward of the perpendicular, if the earth moved.

This proposal of Mr. NEWTON was highly approved of by the Society; and it was desired, that it might be tried as soon as could be with convenience.

Sir CHRISTOPHER WREN supposed, that there might be something of this kind tried by shooting a bullet upwards at a certain angle from the perpendicular round every

every way, thereby to see whether the bullets so shot would all fall in a perfect circle round the place, where the barrell was placed. This barrell he desired might be fixed in a frame upon a plain foot, and that foot placed upon a true plain every way, and the mouth of the gun be almost in the same point over the plain, which way soever shot.

Mr. FLAMSTEAD hereupon alledged, that it was an observation of the gunners, that to make a ball fall into the mouth of the piece, it must be shot at eighty-seven degrees; and that he knew the reason thereof; and that it agreed with his theory: and that a ball shot perpendicularly would never fall perpendicularly: and he mentioned the recoiling of a perpendicular jet of waters. But this was conceived to arise from some mistake of the gunners, in not well taking notice of all circumstances; since a body shot perpendicularly would also descend perpendicularly; and a body shot at eighty-seven degrees would fall considerably distant from the place where it was shot.

December 8. At a meeting of the COUNCIL, at the house of the president, were present,

Sir JOSEPH WILLIAMSON, president,

Sir CHRISTOPHER WREN,	Dr. KING,
Mr. HENSHAW,	Dr. CROUNE,
Sir JOHN HOSKYNS,	Dr. GALE,
Sir ROBERT SOUTHWELL,	Mr. HOOKE.
Dr. HOLDER,	

It was resolved, that there shall be some one subject fixed upon for the Society to proceed upon for the ensuing time, as their main work, till they are satisfied concerning that subject:

That within some reasonable time, as a year, or as soon as they shall be satisfied, that it is brought to perfection, something concerning their progress shall be published:

That in pursuance of this design, some one experiment shall be appointed by the Society at every meeting, to be shewn at the next meeting in prosecution of that subject so made choice of.

That the several members present, when the experiment is appointed, be desired against the next meeting to consult such authors, as have treated of the said experiment or the subject in debate, and to deliver in what they shall meet with concerning it; and also to speak their own opinion of it:

That the first thing done at every meeting shall be the reading over of the notes of what was done at the preceding meeting:

That a particular and diſtinct account and narrative of the experiments made at the preceding meeting ſhall be brought in fairly written by the curator at the following meeting, and be there read before the Society, in order to its being entered in the Regiſter, in caſe the Society think fit ſo to direct:

That whereas it is found, that ſeveral experiments made before the Society theſe late years have been only in the Journal-book, and not in the Regiſter; all ſuch experiments ſhall be forthwith tranſcribed out of the Journal-book, and being firſt made perfect and full by the curator, be then fairly entered in the Regiſter:

That whoever is in the chair the laſt Thurſday of the month do call to the ſecretary and amanuenſis, and ſee, if as well the Journal, as the particular experiments, &c. appointed to be entered in the Regiſter, be entered accordingly; and finding them to be ſo, that under the paper or Journal he write *Entered*:

That likewiſe at the ſame time he view the Letter-books, and ſee, that the letters appointed to be entered be entered accordingly:

That the ſecretaries take care to have a ſmall account of philoſophical matters, ſuch as were the *Tranſactions* by Mr. Oldenburg, and under the ſame title, publiſhed once a quarter at leaſt: and that it be recommended to them to do it monthly, if it may well be; but at leaſt that it be done quarterly.

Mr. Hooke being aſked concerning the undertaking this matter, anſwered, that he would ſee what he could do in it, but could not as yet undertake it abſolutely.

December 10. At a meeting of the Council, at the preſident's houſe, were preſent

Sir Joseph Williamson, preſident,

Mr. Henshaw,	Dr. Gale,
Sir Robert Southwell,	Dr. Croune,
Sir John Hoskyns,	Mr. Hill,
Mr. Evelyn,	Mr. Hooke.
Dr. Holder,	

It was ordered, that Monſ. Papin ſhould be diſcharged, but that he be allowed for the time till he be diſcharged, and paid accordingly.

Mr. Evelyn reported, that he had ſpoken to the earl of Sunderland[1] about ſending the Society's letters in the packets of the ſecretaries of ſtate; and that his lordſhip had readily given his conſent thereto.

Mr. Hooke was deſired to get ſeveral experiments ready againſt the next meet-

[1] Then ſecretary of ſtate.

ing, by reaſon that ſome ſtrangers would be preſent; and Mr. Hunt was ordered to ſummon ſeveral of the members to be preſent.

Dr. Gale was deſired to ſend a letter to the ſeveral perſons in foreign parts, who had formerly correſponded with the Society, and particularly to Mr. Pullein concerning Signor Malpighi, and to aſſure them of a conſtant correſpondence for the future.

Dr. Gale, Dr. Croune, Dr. Allen, Mr. Hill, and Mr. Hooke were appointed a committee to ſee, that a partition be put up in the long gallery of Greſham college.

Dr. Grew mentioned, that Mr. Manwaring was going to the Indies, and undertook to have barometers ſent to the Indies and Barbadoes, with full directions for the uſe of them, and to procure an account from thence of what obſervations ſhould be made.

Dr. Gale promiſed to give the Society for their library all the works of Scotus.

Sir Robert Southwell promiſed to give Weckerus *De Secretis Medicinæ*.

It was ordered, that a paper-book be forthwith provided, in which ſhall be entered all the tranſactions of the council:

That a particular book be provided for entering all ſuch letters, as are written by the ſecretaries to the ſeveral correſpondents at home and abroad; and another for copying all ſuch anſwers and returns, as come to the Society or ſecretaries, from abroad or from any part of England, Scotland, or Ireland.

That a committee be appointed to view the former Letter-books, to ſee how perfect the entries are; and to take an account of all looſe letters recovered from the adminiſtratrix of Mr. Oldenburg, and of thoſe, that have come to the ſecretaries ſince; and to take care, that thoſe, that are not yet entered, be entered forthwith, and that the originals be with all care got together, in order to their being preſerved in ſuch way as the Society ſhall direct. Mr. Hill, Sir John Hoskyns, Dr. Gale, and Dr. Croune, or any two of them, were appointed of this committee.

That a particular preſs be provided to be placed in the gallery appointed for the library, for keeping of all the letters, papers, and books of entries, Journals, Regiſters, and all other written books of the Society under the cuſtody of the ſecretaries; and that a note or liſt be made of all ſuch, as then were or ſhould hereafter be in their keeping, to be for the future interchangeably ſigned between the preſident and the ſecretaries; and that thoſe letters be examined once a year, as at St. Andrew's day:

That some of the best and most entertaining experiments produced before the Society be set apart, and a list taken of them to be at hand, for the entertainment of any person of quality, &c. who shall visit the Society: and

That a committee of experiments be appointed every year, 1. To make a list of what authors have written of physico-mathematical matters: 2. That they charge themselves with one or more of the said authors; and that it be recommended to others of the Society to take part of the rest of such authors for the reading them over, and extracting out of them the principal experiments therein mentioned. 3. That all such experiments so extracted be brought into the committee for experiments, and by them considered of, in order to the presenting to the Society such of them, as they shall think fit to offer to the Society to proceed upon.

December 11. At a meeting of the SOCIETY, Mr. HENSHAW, vice-president, in the chair.

A foreign count was introduced by Mr. EVELYN, together with two other strangers, who had before the sitting of the Society been shewn the repository, the library, and particularly the weather-clock, &c.

The minutes of December 4. were read and approved; and upon the mention of Mr. EVELYN's undertaking to speak to the earl of Sunderland, he being present gave the Society an account, that he had accordingly spoken with his lordship concerning the conveyance of the letters of the Society to and from foreign correspondents in his packet; to which the earl very freely and obligingly gave his consent; for which favour the Society desired, that their thanks might be returned to his lordship by Mr. EVELYN, who was likewise thanked by them for his great care and expedition in this affair.

Upon the mentioning of Mr. NEWTON's letter, and the experiment proposed in it, Mr. HOOKE read his answer to him upon that subject, wherein he explained what the line described by a falling body must be supposed to be, moved circularly by the diurnal motion of the earth, and perpendicularly by the power of gravity: and he shewed, that it would not be a spiral line, as Mr. NEWTON seemed to suppose, but an excentrical elliptoid, supposing no resistance in the medium: but supposing a resistance, it would be an excentric ellipti-spiral, which, after many revolutions, would rest at last in the centre: that the fall of the heavy body would not be directly east, as Mr. NEWTON supposed; but to the south-east, and more to the south than the east. It was desired, that what was tryable in this experiment might be done with the first opportunity.

Mr. HOOKE read an account, which he had procured from Mr. BEAUMONT, of several observations made by himself in divers subterraneous caverns in Somersetshire, viz. in Okey-hole, in a cavern near Chedder, and in the hill called Lamb,

above the parish of Harptry among Mendipp Hills; which account Mr. Hooke intended to print the first opportunity [*].

Hereupon much discourse was maintained about the poisonous nature of several mineral waters. Sir John Lowther mentioned an observation, which had been made by a friend of his, that upon the breaking out of water from a coal-mine, and running into places, where were store of fish, all the fish were observed to be killed thereby.

Mr. Henshaw mentioned, that it was an usual observation, that plumbers could not keep their cats from being killed by licking up the dust of their lead.

Dr. King mentioned, that he living near the white lead works in Hatton Garden, had divers times patients of the labourers in them, sometimes taken with convulsions, sometimes with palsies, sometimes with gripings in their guts, divers of them speechless.

It was remarked likewise, that divers plumbers and gilders are observed to be paralytic, &c.

All which effects were ascribed to the noxious steams proceeding from those metals, upon which they wrought.

Mr. Hooke mentioned, that he had received a letter from Mr. William Balle, and another from Dr. Beal; but it being pretty late, the Society desired to have an account of them at another time, and rose to observe the experiments.

1. An account was given by Mr. Hooke of the experiment for examining the weight of tin, copper, and the mixture of tin and copper, and the way and reason thereof explained.

2. The experiments formerly in the Society were again exhibited for the entertainment of the foreign count then present, viz. those for explaining the nature of fire; the first of which was that of a chafing-dish of burning coals included in a box with bellows to blow the satiated air upon them: the second was that of sealing up a charcoal in a pipe of glass, and keeping it in a very hot fire for about an hour and an half; the effects of both which were the same with those, that had been formerly shewn in the Society, and entered into the Journals.

Monf. Papin produced a peach, which he had the last summer inclosed in a glass with artificial air condensed, and on cutting the same, it was found very sound and plump. He gave no farther account thereof, but that it was an experiment of Mr. Boyle, of which he was now printing an account, which would shortly be published.

[*] It is published in his Philosophical Collections, n° 2, p. 1. at London, 1681. in 4to.

Monf.

Monf. Papin produced likewife his wind-gun made in a walking-ftick, with which he fhewed, firft, the extraordinary condenfation of the air therein, by letting it leifurely out into a glafs filled with water; of which an account is made in the Journal-book:

And next he charging it again with condenfed air, fhot a bullet with it in the gallery; the effect being much the fame with thofe of fome other experiments in the fame gun formerly made ufe of; accounts of which were entered in the Journal-books of this year.

Mr. Thomas Pigot, fellow of Wadham College in Oxford, was propofed a candidate by Sir John Hoskyns.

December 17. At a meeting of the Council, at the prefident's houfe, were prefent,

Sir Joseph Williamson, prefident,

Sir Robert Southwell,	Dr. Croune,
Sir William Petty,	Dr. Grew,
Sir John Hoskyns,	Dr. King,
Mr. Henshaw,	Mr. Hill,
Dr. Holder,	Mr. Hooke.
Dr. Gale,	

Mr. Hill, Dr. Gale, Dr. Croune and Sir John Hoskyns were appointed a committee to meet at Mr. Hooke's lodgings on the Monday following, to fee the letters in his cuftody.

It was ordered, that a lift be made by the fecretaries of all letters, that had come to their hands during the whole year; and that at the end of each year fuch a lift be delivered to the prefident.

Mr. Hooke was defired to continue the *Philofophical Collections* [a].

Dr. Gale was defired to undertake all foreign correfpondence, which he accordingly did; as alfo that he would forthwith write to Signor Malpighi, Borelli, and Mr. Pullein; and that he would apologize to the correfpondents for the defect of returns; which fhould have been made from hence.

[a] The firft number was printed at London, 1679, in 4to, by Mr. Martyn, printer to the Society, under this title: *Philofophical Collections, containing an account of fuch phyfical, anatomical, chymical, mechanical, aftronomical, optical, or other mathematical and philofophical experiments and obfervations, as have lately come to the publifher's hands. As alfo an account of fome books of this kind lately publifhed.* The fecond Number was printed at London, for Moses Pitt in 1681; the third for R. Chiswell, and dated December 10, 1681, with an Advertifement, that thefe *Collections* would for the future be publifhed once a month at leaft; wherein would be contained an account of all fuch new difcoveries of nature or art, as fhould occur to the collector in the modern books or writings of learned men, either at home or abroad. The fourth Number is dated, January 10, $168\frac{1}{2}$: the fifth, in February, $168\frac{1}{2}$; the fixth, in March, $168\frac{1}{2}$, and the feventh and laft in April, 1682.

Mr.

Mr. HOOKE propounding, that it was neceſſary for him to have a perſon, who might be conſtantly by him, and employed in the making and preparing of ſuch trials and experiments, as ſhould, when perfected, be ſhewn and repreſented to the Society at their meetings; it was ordered, that he ſhould have liberty forthwith to employ ſuch perſon, as he ſhould agree with; and that the Society would allow for the hire of ſuch perſon thirty-two pounds *per annum*.

December 18. At a meeting of the SOCIETY, Mr. HENSHAW, vice-preſident, in the chair.

WILLIAM NAPPER, Eſq; was admitted.

WILLIAM BRIDGEMAN, Eſq; and Mr. PIGOT were elected.

Mr. JOSEPH MOXON preſented to the Society one of his Engliſh globes, together with a book, containing the explication and uſe thereof [o], with a deſire, that it might ſtand in the meeting-room, to be ſeen at the meetings of the Society. And Mr. HUNT was directed to get a wooden caſe made for it to ſtand in the meeting-room.

Mr. HOOKE read his anſwer to Mr. NEWTON's former letter; as alſo another letter, which he had received from Mr. NEWTON, containing his farther thoughts and examinations of what had been propounded by Mr. HOOKE.

Mr. HOOKE gave alſo an account, that he had made three trials of the experiment propounded by Mr. NEWTON, and had found the ball in every one of the ſaid experiments fall to the ſouth-eaſt of the perpendicular point, found by the ſame ball hanging perpendicular. But the diſtance of it from the perpendicular point being not always the ſame, and the experiment having been made without doors, in the open air, nothing of certainty could be concluded from it. But he alledged, that he deſigned to make a trial of it within doors, where there would be leſs motion of the air; and he hoped to be able to do it before the next meeting of the Society.

Mr. HOOKE read a letter of ERASMUS BARTHOLINE, which he had received from the preſident, directed to Dr. GREW, and dated at Copenhagen, 23d February, 1679 [p]; in which the writer expreſſed his readineſs to correſpond, and incloſed a treatiſe of his nephew, CASPAR BARTHOLINE, *De Organo Olfactus*; which treatiſe was delivered to Dr. CROUNE to peruſe and give an account of it at the next meeting, in order that an anſwer might be ſent to the letter.

Mr. HENSHAW preſented the Society with a printed account of the great loſs ſuſtained by Mr. HEVELIUS in the late fire at Dantzick; which account was ſent from Hamburgh by Sir PETER WYCHE, to whom that account was dedicated.

[o] See Mr. HOOKE's Philoſophical Collections, nº 1. p. 43.

[p] Letter-book, vol. viii. nº 68.

Mr.

Mr. HOOKE shewed a new book of Signor VIVIANI, sent to himself by the author, containing several solutions of the problem propounded by Mr. CONYERS of trisecting an angle, and finding two mean proportionals. Two other copies were likewise sent, one for the president, and the other for Mr. COLLINS, which were accordingly delivered.

Hereupon Sir ROBERT SOUTHWELL promised to present to the Society for their library Signor VIVIANI's book *De Maximis & Minimis*.

Mr. HENSHAW read a paper, which he had received from Dr. PLOT, copied from the Records in the Tower, containing an account of the strange recovery of certain persons a long time after their having been executed.

The experiments shewn were the trials with the box, in which the chafing-dish of live coals were placed; and the time was observed, how long it continued there before the coals seemed quite extinct and black. Then the same chafing-dish was again filled with live coals, and included, and the bellows were kept continually blowing upon them; and the time being also observed, how long it was before they also were quite extinct, it was found, that the times of continuance in both experiments were the same.

There were two other experiments ready, which the Society had not time to see tried, it being late; for which reason they were reserved to the next meeting.

THE END OF THE THIRD VOLUME.